THE OHIO JOURNAL OF SCIENCE

Vol. XXIII SEPTEMBER–OCTOBER, 1923 No. 5

REPORT OF THE THIRTY-THIRD ANNUAL MEETING OF THE OHIO ACADEMY OF SCIENCE

The Thirty-third Annual Meeting of the Ohio Academy of Science was held at Oberlin College, Oberlin, March 30 and 31, 1923, under the Presidency of Professor Albert P. Weiss. Fifty-five members were registered as in attendance; twenty-five new members were elected.

The annual excursion of the Section for Geology was held on May 25, 26 and 27, under the general management of Professor J. Ernest Carman, Vice-President for 1923–24. The party gathered fifty strong at Newark, Ohio. The first day was devoted largely to archeology, in the study, under the guidance of Dr. W. C. Mills, of the earthworks near Newark and the flint quarries of Flint Ridge. Mr. Wilber Stout directed the remainder of the trip, which was planned for the observation of the Pennsylvanian and Permian rocks, the Quaternary molding sand deposits, and the topography of Muskingum County.

GENERAL PROGRAM.

FRIDAY, MARCH 30.

9:30 A. M.—Business Meeting.
11:00 A. M.—Reading of Papers in General Session.
12:30 P. M.—Luncheon.
2:00 P. M.—Illustrated Lecture by Professor Henry C. Cowles, of the University of Chicago, on "Trees as Witnesses in Boundary Disputes; and Instance of Applied Ecology."
3:00 P. M.—Reading of Papers in Sectional Meetings.
6:30 P. M.—Dinner.
8:00 P. M.—Address by the President of the Academy, Professor Albert P. Weiss, of Ohio State University, on "The Aims of Social Evolution."

SATURDAY, MARCH 31.

9:00 A. M.—Adjourned Business Meeting.
10:30 A. M.—Reading of Papers in General Session.
12:30 P. M.—Luncheon.
2:00 P. M.—Demonstrations.
2:30 P. M.—Reading of Papers in Sectional Meetings.

FRIDAY, MAY 25, TO SUNDAY, MAY 27.

Excursion of Section for Geology, Muskingum County.

MINUTES OF BUSINESS MEETINGS.

The first business session was called to order by President Weiss at 9:30 A. M., on Friday, March 30; an adjourned session was held at 9:00 A. M. on the following day.

The appointment of the following committees for the meeting was announced by the chair:

Committee on Membership—W. M. Barrows, Lynds Jones, E. L. Fullmer.

Committee on Resolutions—C. H. Kennedy, R. C. Osburn, G. D. Hubbard.

Committee on Necrology—T. C. Mendenhall.

The following *Auditing Committee* was elected by the Academy: Stephen R. Williams, M. M. Metcalf.

The following *Nominating Committee* was elected by the ballot of the Academy: R. C. Osburn, E. Lucy Braun, G. D. Hubbard, T. C. Mendenhall, C. G. Rogers, A. P. Weiss.

Report of the Secretary.

The following report by the Secretary was received and ordered filed.

March 30, 1923.

To the Ohio Academy of Science:

The work of the Secretary for the last year has been almost entirely routine. The following items may be reported for the sake of record.

A brief report of the Thirty-second Annual Meeting was sent to *Science*, and appeared in the number for September 8.

The Secretary was present to represent the Academy in the Council of the American Association for the Advancement of Science at the Boston Meeting.

The certificate of election to fellowship has been mailed, as directed by the Academy, to the fellows elected in 1920 and 1921, as well as to those elected in 1922.

Respectfully submitted,

EDWARD L. RICE, *Secretary.*

Report of the Treasurer for the Year 1922-1923.

The report of the Treasurer was received as follows and referred to the Auditing Committee, whose report is appended.

RECEIPTS.

Balance April 12, 1922, as previously reported	$ 617.52	
Librarian's sales of publications, 1921–1922	37.00	
Librarian's sales of publications, 1922–1923	23.45	
Membership dues, A. A. A. S. and the Ohio Academy	1,311.00	
Total receipts		$1,988.97

DISBURSEMENTS.

American Association for the Advancement of Science	$693.00	
The Ohio Journal of Science	350.00	
Spahr and Glenn, printing	75.00	
E. L. Rice, Secretarial expenses	33.10	
Independent Print Shop	45.50	
Lynds Jones, for expenses, executive committee	12.32	
B. V. Bevin	2.00	
Eunice Evans, stenographic work	10.00	
Returned check	2.00	
Total disbursements		$1,222.92
Balance on hand, 1922–1923		$ 766.05

A. E. WALLER, *Treasurer.*

The accounts herewith and vouchers checked over and found to be correct.

STEPHEN R. WILLIAMS,
MAYNARD M. METCALF,
Auditing Committee.

The following financial statement of Mr. L. H. Tiffany, manager of the Ohio Journal of Science, while not strictly a part of the Treasurer's Report, is appended for the information of the Academy.

FINANCIAL STATEMENT OF THE OHIO JOURNAL OF SCIENCE.
(Volume XXII, 1921–22. The Ohio Journal of Science).

RECEIPTS.

Ohio State University Allowance	$500.00	
A. E. Waller, Treasurer, Ohio Academy of Science	250.00	
Reprints, extra copies of Journal	218.40	
Total receipts		$968.40

EXPENDITURES.

Bucher Engraving Company	$ 58.18	
Stenographic Work	3.50	
Postoffice Deposit	3.89	
Stamps, mailing and stationery	64.47	
Total expenditures		$130.04
Balance on hand 1921–22		$838.36
Estimated cost of the Journal, 1921–22		$1,000.00
Cash on hand, 1921–22		838.36
Deficit for 1921–22		161.64
Deficit for 1920–21		447.31
Total deficit		$ 508.95

Report of the Executive Committee.

The report of the Executive Committee was received as follows and ordered filed.

March 30, 1923.

To the Ohio Academy of Science:

A meeting of the Executive Committee was held in Columbus, October 21, 1922. All members were present.

At this meeting the invitation to hold the Thirty-third Annual Meeting at Oberlin College was accepted, and the meeting was set for March 30 and 31.

The Secretary was instructed to arrange, if practicable, for the publication in the Ohio Journal of Science of a brief obituary notice of Mr. Emerson McMillin, in anticipation of a more adequate memorial to be presented at this meeting. The late appearance of this notice (in the January-February number) was unavoidable, because of the readjustment of the dates of publication of the Journal.

The Secretary presented a letter of June 10 from President Charles D. Walcott, of the Spencer Fullerton Baird Memorial, announcing plans for the celebration of the one-hundredth anniversary of the birth of Spencer Fullerton Baird, February 3, 1923, and inviting the Academy to designate a representative on the national committee. The letter closes with these paragraphs:

"Among the suggestions that have been made for a permanent national memorial are (1) a bust, statue, mural or open-air fountain, or bronze mural tablet to be provided by voluntary subscriptions and erected in the grounds of the Smithsonian Institution or the National Zoological Park, and (2) a fishery museum or exhibit, with public aquarium, embracing both the scientific and applied features of fishery problems, to be established by Congress under the auspices of the Smithsonian Institution.

"It has been suggested also that there be established a Baird Memorial Medal to be awarded periodically to persons performing noteworthy original or meritorious work in science, and that there be published during 1923, preferably under the auspices of the National Museum or the Smithsonian Institution, a memorial volume to be made up of original papers on scientific subjects contributed by Baird's associates, colleagues, and immediate followers.

"In advising me that your organization will be represented on the national Baird memorial committee, will you kindly communicate your views on the general subject of the memorial?"

The action of the Executive Committee is shown in the following quotation from the reply to Dr. Walcott's letter:

"Our committee was enthusiastically in favor of such a memorial and appointed Dr. Raymond C. Osburn, of Ohio State University, as our representative. As to the particular form of memorial, the consensus of opinion was in favor of the fountain or aquarium, rather than the other alternatives suggested in your letter. Dr. Osburn was, however, left without formal instructions."

On the suggestion of the Treasurer, it was voted to allow to each new member the option of receiving the back numbers of the Ohio Journal of Science from January to the time of election or of commencing the Journal with the following January, as he may prefer.

A second meeting of the Committee was held in Oberlin on March 29, 1923. All members present.

In accordance with the instructions of the last Annual Meeting, the Committee has prepared a series of amendments to the Constitution, establishing the Committee on State Parks and Conservation as a standing committee of nine members, and providing for the election of three members each year for a term of three years. These amendments will be presented for adoption later in the session. The expiration of the term of office of the committee membership was determined by lot, as follows: Herbert Osburn, Chairman, 1925; E. Lucy Braun, 1924; J. E. Carman, 1924; Bruce Fink, 1926; E. L. Fullmer, 1925; E. R. Hayhurst, 1926; F. H. Herrick, 1925; C. G. Shatzer, 1924; E. N. Transeau, 1926.

The Committee voted to recommend that the Academy heartily endorse the efforts of the Ohio College Association toward the securing of uniformity in date of the spring vacation of the colleges of Ohio, as facilitating attendance at meetings of the Ohio College Association, Ohio Academy of Science, and other societies consisting largely of college men.

The Committee also voted to recommend to the Academy an amendment of the By-Laws providing an annual honorarium of one hundred dollars for the Secretary, this honorarium to include expenses for clerical assistance.

Sixteen applications for membership have been approved, subject to final ratification by the present meeting.

Respectfully submitted,

EDWARD L. RICE, *Secretary.*
For the Committee.

Report of the Publication Committee.

The following report of the Publication Committee was received and ordered filed.

The Annual Report of the Thirty-second Meeting, Proceedings, Vol. VII, Part 7, contained 36 pages and was published March 1, 1923.

The report minus the membership list was also published in the Ohio Journal of Science 23 : 1–24, 1923.

Respectfully submitted,

H. C. SAMPSON, *Chairman.*

Report of the Library Committee.

The following report of the Library Committee was received and ordered filed.

March 29, 1923.

To the Ohio Academy of Science:

The Library Committee begs to report that all the duties devolving upon it have been discharged as promptly as possible.

The sale of publications during the year amounted to $23.45. This amount has been turned over to the Treasurer of the Academy.

The Proceedings of the Thirty-second Annual Meeting, 1922, were received from the printer on March 12, 1923. Copies were mailed immediately to all persons on the membership roll, and to all institutions on the exchange list.

The publications which have been received on exchange have been added to the others previously filed in the University Library. The University Library would like to see more use made of these exchanges and other scientific sets by the members of the Academy who are non-resident in Columbus. The University Library annually renews its offer to lend to the members of the Academy, through their home libraries, the scientific publications needed in their research work.

The writer of this report desires to call the attention of the Academy to Section 3 in House Bill No. 400, "A bill relative to state recognition of the Ohio Academy of Science" now before the 85th General Assembly. On page 2, lines 28, 29 and 30, read as follows: "All exchanges received shall be kept available to the citizens of the state through the Ohio State Library, or such other channel as may be determined." . . . While not wanting to say anything to affect the cordial relations existing between the Ohio State Library and the Ohio State University Library, yet be it said that if an individual library is to be specified in the bill, it ought to be the library which is at present, and has been for eight years handling the exchanges of the Academy, namely, the Ohio State University Library. If the bill should be made to read that exchanges were to be kept at such a place as may be determined by the Academy, no objection could be made, because the question of the disposition of its property is a right inherent in the organization.

Furthermore, it may not be known to the members of the Academy, but the facts are that the State Library and the University Library are dividing the field between the two institutions, whereby the technical and scientific literature is to be developed by the University Library. In accordance with this plan, it would naturally fall to the University Library to handle and make available any scientific literature received by the Academy.

Section 3 of this bill also needs redrafting, especially as it relates to the distribution of the publications of the Academy. As drafted, it provides that one copy of the Proceedings shall be sent to each public library and museum, university, college, normal school and first grade high school. It also provides that one copy of the Ohio Journal of Science shall be sent to each university and college. Then, it provides that "not less than one hundred copies of each publication shall be distributed through the Ohio State Library." Since the provision is made specifically for the distribution of the publications, to whom is the State Library to send its one hundred copies?

Furthermore, the Academy does not control the Ohio Journal of Science. If such is the case, can this bill, which relates to the Academy, provide for the distribution of the Journal, for the handling of its exchanges, and for grant of one hundred copies to the Ohio State Library?

The Ohio State University has been paying to the Ohio Journal of Science $500.00 a year, for which sum 250 copies of each issue have been allotted the University Library for exchanges. Under the proposed legislation, some complications are likely to occur if such exchanges are to be deposited in the Ohio State Library.

These statements are made with the friendliest of feelings, but with the purpose of pointing out some features in Section 3 which need more study, in order to keep the Academy from difficulties into which it may unknowingly place itself.

This bill was introduced into the House by Mr. Riggs on February 21st; was read the second time on February 28th, and then referred to the Committee on State and Economic Betterment. It was reported out on March 23d.

If the Academy feels that these points are of importance, it may be proper to instruct its Legislature Committee to seek the desired changes in the bill, either as amendments on the floor, or in the Senate committee, should the bill pass the House.

Respectfully submitted,

By C. W. REEDER,
For the Library Committee.

Report of the Trustees of the Research Fund.

The following report of the Trustees of the Research Fund was received and referred to the Auditing Committee, whose report is appended.

To the Ohio Academy of Science:

The Trustees of the Research Fund submit the following Report for the period from March 29th, 1922, to March 30th, 1923.

RECEIPTS.

Cash on hand March 28th, 1922	$1,090.20	
Interest on bonds	36.12	
		$1,126.32

EXPENDITURES.

May 8th, 1922, Postage	$ 2.00	
June 12th, L. B. Walton	35.80	
July 24th, Francis H. Herrick	99.75	
August 19th, L. H. Tiffany	47.71	
September 16th, James E. Kindred	75.00	
December 8th, E. L. Stover	16.20	
March 13th, 1923, Raymond A. Dobbins	26.30	
		$ 302.76

ASSETS.

Cash on hand March 29th, 1923	$823.56	
Liberty Bonds at par	600.00	
		$1,423.56

LIABILITIES.

Balance on grants to:		
L. H. Tiffany	$ 2.29	
R. A. Dobbins	73.70	
E. L. Stover	33.80	
Francis H. Herrick	.25	
		$ 110.04
Excess of cash assets above liabilities		$ 713.52

Vouchers are submitted herewith.

T. C. MENDENHALL, *Chairman,*
GEO. D. HUBBARD,
HERBERT OSBORN,
Trustees.

Books audited and found correct.

STEPHEN R. WILLIAMS,
MAYNARD M. METCALF,
Auditing Committee.

Report of the Committee on State Parks and Conservation.

The following report of the Committee on State Parks and Conservation was received and ordered filed.

To the Ohio Academy of Science:

Your Committee can not report any very extensive activity during the past year, but there are several matters of interest which it will be proper to mention.

The final acquisition and dedication of the Roosevelt Park in southern Ohio establishes an extensive and very desirable tract as a permanent game refuge in which we can be assured of the preservation of the natural conditions; and it would appear a very satisfactory arrangement for control between the Fish and Game Commission and State Forester, both of whom, no doubt, will accept suggestions concerning biological features that may be of service.

Under the Silver Bill the State Forester has secured additional tracts for State Forestry purposes, and these, of course, are distinct advances in the matter of preservation of the native flora and fauna.

The present Legislature has enacted or will probably enact a Bill accepting the Bryan farm near Yellow Springs, a tract of something over 500 acres, which was given to the State for preservation as a game refuge, and experiment farm, and under the conditions provided in the present act, will doubtless furnish an additional valuable tract for the preservation of natural conditions.

The transfer of a tract of fifty-seven acres, including the Harness Mounds from the United States Government to the State, under the control of the State Archeological Society, gives us another interesting tract as a public park.

Failure of the National Congress to pass the bill to provide for national game reserves, which would have made possible the preservation of swamp areas and other suitable breeding grounds for migratory fowl, makes it, of course, more desirable that the State should set aside a number of such tracts within our boarders for the purpose of conserving wild life dependent upon such conditions. It seems therefore that one of the early movements of the Academy should be to secure, through the Fish and Game Commission or such other channel as may be available, certain reservations of this character.

The waterways project now being considered by the National Government, which would provide a waterway from the Lake to the Ohio River, is a matter of very distinct interest to the members of the Academy, especially in reference to its features of conservation and utilization of water resources in the State. Such a waterway with its reservoir system would make some very important additions to the water areas and utilization, and your Committee will endeavor to keep in close touch with progress in this line.

Respectfully submitted,

HERBERT OSBORN, *Chairman*,
FRANCIS H. HERRICK,
E. N. TRANSEAU,
J. ERNEST CARMAN,
C. G. SHATZER.

Report of the Committee on Legislation.

The following report, presented by the Committee on Legislation, was received as a report of progress, and the Committee was continued. In view of the questions raised in the Report of the Library Committee with reference to the bill for State recognition of the Academy, Mr. Reeder was added to the Committee on Legislation.

The Committee is able to report that a bill for the recognition of the Ohio Academy has been introduced in the Legislature, and two members of the Committee had a conference with the Committee to which the bill was referred. It received a very cordial consideration, and so far as this Committee is concerned, it appears that the bill will

have cordial support. Just what fate it may have in the House we cannot say. Furthermore, the bill will have to be acted upon by the Senate, and considering the lateness of the session, we are somewhat in doubt as to the outcome.

The bill as drafted was changed in two particulars from the bill as agreed upon in the Academy, but the changes made, we believe, will not defeat the objects of the proposed relation to the State. If passed, it should enable the Academy to extend its usefulness and to secure modifications if necessary in the future.

We recommend that the Committee be continued or a new Commit tee appointed with authority to adjust the constitution and make any arrangement of details necessary in the carrying out of the provisions of the bill.

Respectfully submitted,

HERBERT OSBORN, *Chairman*,
T. C. MENDENHALL,
W. H. ALEXANDER,
EDWARD L. RICE,
MAYNARD M. METCALF.

Election of Officers.

The following officers and committee members for 1923-24 were elected by the ballot of the Academy.

President—Professor K. F. Mather, Denison University, Granville.

Vice-Presidents:

Zoology—Professor W. M. Barrows, Ohio State University, Columbus.

Botany—Professor H. H. M. Bowman, Toledo University, Toledo.

Geology—Professor J. E. Carman, Ohio State University, Columbus.

Physics—Mr. W. C. Devereaux, U. S. Weather Bureau, Cincinnati.

Medical Sciences—Professor B. M. Patten, Western Reserve University, Cleveland.

Psychology—Professor H. A. Aikins, Western Reserve University, Cleveland.

Secretary—Mr. W. H. Alexander, U. S. Weather Bureau, Columbus.

Treasurer—Dr. A. E. Waller, Ohio State University, Columbus.

Elective Members of Executive Committee—Professor A. P. Weiss, Ohio State University, Columbus; Professor E. L. Rice, Ohio Wesleyan University, Delaware.

Member of Publication Committee—Professor L. B. Walton, Kenyon College, Gambier.

Trustee of Reserach Fund—Professor Herbert Osborn, Ohio State University, Columbus.

Member of Library Committee—Professor F. O. Grover, Oberlin College, Oberlin.

Representatives on Editorial Board of Ohio Journal of Science:

Zoology—Professor R. A. Budington, Oberlin College, Oberlin.
Botany—Professor Bruce Fink, Miami University, Oxford.
Geology—Professor G. D. Hubbard, Oberlin College, Oberlin.
Physics—Professor S. J. M. Allen, University of Cincinnati, Cincinnati.
Medical Sciences—Professor F. C. Waite, Western Reserve University, Cleveland.
Psychology—Professor H. A. Aikins, Western Reserve University, Cleveland.

Election of Members.

The Membership Committee reported nine names for election to membership; sixteen additional names, previously approved by the Executive Committee and marked with (*) in the following list, were presented for ratification. All were elected, as follows:

*Bangham, Ralph V.; Zoology, Anatomy; Dept. of Zoology and Entomology, Ohio State University, Columbus.
Beam, J. Albert; Zoology; 174 Greenfield St., Tiffin.
*Bohstedt, G.; Animal Nutrition and Genetics; Ohio Agricultural Experiment Station, Wooster.
*Bryant, William L.; Vertebrate Paleontology, American Anthropology; 1231 Elmwood Ave., Buffalo, N. Y.
Culp, Vernon L.; Chemistry, Biology, Physiography; 837 Berwyn St., Akron.
*Deam, Charles C.; Botany, Forestry; Bluffton, Ind.
*Dean, Forest W.; Forestry, Botany, Entomology; Ohio Agricultural Experiment Station, Wooster.
*Freer, Ruskin S.; Botany; East Liberty.
*Gilmor, Grace; Plant Physiology, Botany; R. D. No. 1, Wooster.
Hartzell, Albert; Entomology, Zoology; Dept. of Zoology and Entomology, Ohio State University, Columbus.
*Hitchcock, Fred A.; Zoology, Physiology; 1254 Wesley Ave., Columbus.
*Inman, Ondess L.; General Physiology; Antioch College, Yellow Springs.
Irwin, N. Mildred; Botany; 6405 Roe St., Cincinnati.
*Johnson, Howard W.; Botany; Dept. of Botany, Ohio State University, Columbus.
Jones, Edward S.; Psychology; 79 S. Cedar St., Oberlin.
McEwen, Robert Stanley; Zoology; 208 Forest St., Oberlin.
Painter, Donald H.; Geology; 318 Grand Ave., Dayton.
*Phillips, T. G.; Chemistry, Botany; Dept. of Agricultural Chemistry, Ohio State University, Columbus.
*Swinnerton, Allyn C.; Geology; Antioch College, Yellow Springs.

VanHorn, Jesse Lower; Chemistry and Physics; 1490 Roycraft Ave., Lakewood.
*Werner, William C.; Botany; 422 N. St. Clair St., Painesville.
*Whipple, Ralph W.; Geology, Mineralogy, Paleontology, Anthropology; Marietta College, Marietta.
*Willard, C. J.; Agronomy, Botany; Ohio State University, Columbus.
Wilson, Herrick E.; Geology, Zoology, Medicine; 224 W. College St., Oberlin.
*Young, W. J.; Botany; Ohio Agricultural Experiment Station, Wooster.

Report of the Committee on Election of Fellows.

The following report of the Committee on Election of Fellows was accepted and ordered filed.

March 30, 1923.

To the Ohio Academy of Science:

A meeting of the Committee on Election of Fellows was held last evening in Oberlin. Six members of the committee were present; three were represented by duly authorized proxies; two were absent without representation.

Of the candidates considered eight received the necessary nine favorable votes and were declared elected. The fellows elected will be personally notified, and the list will be published in the Proceedings.

Respectfully submitted,

Edward L. Rice, *Secretary*,
For the Committee.

The list of members elected to fellowship is as follows:

William Letchworth Bryant
Walter C. Kraatz
Paul Marshall Rea
Septimus Sisson
Warren N. Thayer
Roy Curtis Thomas
Lewis Hanford Tiffany
Edward L. Wickliff

Resolutions.

The following resolutions were adopted by the Academy:

1. The Ohio Academy of Science hereby extends its cordial thanks to the Local Committee and the authorities of Oberlin College for the careful arrangements and many courtesies which have made possible this most successful meeting.

2. The Academy desires also to thank Professor Henry C. Cowles, of the University of Chicago, for the fascinating address on "Trees as Witnesses in Boundary Disputes: an Instance of Applied Ecology," and for his participation in the symposium on "Geographical Distribution of Plants and Animals."

3. The Academy further expresses to Professor Rice its gratitude for his years of service as secretary, a service involving much sacrifice on his part; and we record our appreciation of the fact that the increasing strength of the Academy during the last decade has been due in considerable measure to his influence.

Report of the Committee on Necrology.

The report of the Committee on Necrology consisted of a memoir of Emerson McMillin, 1844–1922, prepared and read by Dr. T. C. Mendenhall. The report was adopted by the Academy. By action of the Executive Committee and Trustees of the Research Fund for 1923–24, to whom, as a joint committee, the matter was referred with power, this memoir has already appeared in the Ohio Journal of Science for May-June, 1923, and is omitted from the Annual Report.

Amendments of Constitution.

ART. IV, SECTION 6*a*. *Committee on State Parks and Conservation.* New section, to be renumbered on reprinting of Constitution. The Committee on State Parks and Conservation shall consist of nine members elected in accordance with the provisions of Section 16.

ART. IV, SECTION 15*a*. *Duties of Committee on State Parks and Conservation.* New section, to be renumbered on reprinting of Constitiuton. The Committee on State Parks and Conservation shall consider the various possibilities in the formation of State Parks in areas of scenic, geologic, or biologic interest, and other effective methods for the preservation of the native fauna and flora and for the conservation of the natural resources of the State; it shall co-operate in all possible ways with other societies, institutions, and State officers in the promotion of these objects.

ART. IV, SECTION 16. *Terms of Office.* Amended to read: The President, Vice-Presidents, Secretary, Treasurer, and elective members of the Executive Committee and Publication Committee shall be elected annually at the annual meeting, and shall be eligible to re-election without limitation, with the exception of the President, who shall not be elected for successive terms. The Trustees of the Research Fund, the members of the Library Committee, and the members of the Com-

mittee on State Parks and Conservation shall be elected for a term of three years, one Trustee, one member of the Library Committee, and three members of the Committee on State Parks and Conservation being elected each year.

Amendment of By-Laws.

CHAPTER II, SECTION 3. *Honorarium of Secretary.* New section. The Secretary shall receive an annual honorarium of one hundred dollars, from which he shall pay for any clerical help employed.

McMillin Prize.

A recommendation was presented by Dr. T. C. Mendenhall, for the Trustees of the Research Fund, that the research fund of the Academy be invested as a permanent endowment, and that the interest derived from the same be devoted to a prize bearing the name of Mr. Emerson McMillin.

The general plan was endorsed by the Academy, and the working out of details was referred to the Executive Committee and the Trustees of the Research Fund for report at the next annual meeting. For the year 1923–24 the use of the income of the research fund was referred to the Trustees with power.

Uniform Spring Vacation.

On the recommendation of the Executive Committee, it was voted that the Ohio Academy of Science heartily endorse the efforts of the Ohio College Association toward the securing of uniformity in the date of the spring vacation of the colleges of Ohio, as facilitating attendance at meetings of the Ohio College Association, Ohio Academy of Science, and other societies consisting largely of college men.

Scientific Sessions.

The complete scientific program of the meeting follows:

PRESIDENTIAL ADDRESS.

The aims of social evolution.....A. P. Weiss

PUBLIC LECTURE.

Trees as witnesses in boundary disputes: an instance of applied ecology, Henry C. Cowles

SYMPOSIUM ON GEOGRAPHICAL DISTRIBUTION OF PLANTS AND ANIMALS.

Geological factors in animal and plant distribution.....G. D. Hubbard
Some factors in plant distribution.....H. C. Cowles
The distribution of vegetation in relation to physiographic provinces, E. Lucy Braun
The places of origin of the several families of Anura.....M. M. Metcalf
Factors which determine local distribution of spiders.....W. M. Barrows
Some problems in the distribution of dragonflies. (Lantern), Clarence H. Kennedy

SYMPOSIUM ON CURRENT PROBLEMS OF OHIO GEOLOGY.

Early Paleozoic stratigraphy.....W. H. Shideler
Middle Paleozoic stratigraphy.....J. Ernest Carman
Stratigraphy of the Carboniferous formations.....J. E. Hyde
Paleozoic faunas and their correlation.....A. F. Foerste
Some work yet to be done in Ohio physiography.....Geo. D. Hubbard
Economic geology.....J. A. Bownocker
Structural geology.....W. H. Bucher

PAPERS.

1. Weather and human conduct. (30 min., lantern)..William H. Alexander
2. Some Old World botanic gardens. (25 min., lantern).....A. E. Waller
3. Some features of the Park Area of the Cleveland Metropolitan Park District. (20 min., lantern).....E. L. Fullmer
4. The Cleveland Museum of Natural History. (25 min.).....P. M. Rea
5. An "eagle" observatory at Vermilion; results obtained in 1922. (40 min., lantern).....Francis H. Herrick
6. A contribution to our knowledge of the life history and physiology of Euglena. (15 min.).....W. J. Kostir
7. The so-called allelocatalytic effect in the reproduction of Protozoa. (5 min.).....W. J. Kostir
8. The persistence of archaic parasites through many geologic periods. (10 min., opaque projection).....Maynard M. Metcalf
9. The origin of American opalinids. (15 min., opaque projection), Maynard M. Metcalf
10. Two new cestode parasites in black bass of Ohio; life history, distribution, etc. (10 min.).....Ralph V. Bangham
11. Life history studies of Homoptera. (10 min., lantern)...Herbert Osborn
12. Jumping mouse, Zapus hudsonius, in Ohio. (10 min.).....H. A. Gossard
13. The geographic distribution of Arctic Bryozoa. (10 min., lantern), Raymond C. Osburn
14. The inheritance of the nail-biting habit. (10 min., lantern), W. M. Barrows
15. A case of extra digits in the manus of the pig. (10 min., lantern), Stephen R. Williams
16. On the origin of some embryonic abnormalities. (10 min.)..R. A. Budington

17. Comparative physiology as an undergraduate study. (15 min.), CHAS. G. ROGERS
18. Physiological evidences of animal relationship. (15 min.). . CHAS. G. ROGERS
19. Lorain County Polyporaceae. (5 min.) ..... F. O. GROVER
20. The vegetation of Ohio. (Lantern) ..... E. N. TRANSEAU
21. Studies on the genus Ampelopsis. (15 min., lantern) ..... GRACE GILMOR
22. Variations in the root system of the common everlasting Gnaphalium polycephalum. (10 min.) ..... HELEN GUHMAN
23. Soil reactions and plant succession. (15 min.), E. LUCY BRAUN AND SYLVIA GEISLER
24. Importance of resistance of the host in the control of plant diseases. (20 min.) ..... W. J. YOUNG
25. Observations on the sexual state of various plants. (15 min.), J. H. SCHAFFNER
26. The time of sex determination in plants. (12 min.) ..... J. H. SCHAFFNER
27. Some chemical changes accompanying growth and reproduction in Spirogyra. (15 min.) ..... L. H. TIFFANY
28. Flora of the muck land of Delaware County, Indiana. (10 min.), BLANCHE MCAVOY
29. Notes on the distribution of sea grasses. (10 min., lantern), H. H. M. BOWMAN
30. Prairie openings on the Little Miami River. (20 min., lantern), M. MILDRED IRWIN
31. Concerning some ostracoderms from Ohio. (15 min., lantern), J. ERNEST CARMAN
32. The temperature and brightness of tungsten lamps. (20 min), W. E. FORSYTHE
33. Effect of tension on change of resistance and thermoelectromotive force by transverse magnetization ..... ALPHEUS W. SMITH

DEMONSTRATIONS.

1. Methods of recording bird migration ..... LYNDS JONES
2. Drawings of penes of dragonflies ..... CLARENCE H. KENNEDY
3. Preserved skin specimen of jumping mouse, Zapus hudsonius. . H. A. GOSSARD
4. A cent found in the pharynx of a cat from the comparative anatomy laboratory ..... STEPHEN R. WILLIAMS
5. Microscopic slides illustrating paper 13, on cestode parasites of black bass, RALPH V. BANGHAM
6. Roots of the common everlasting Gnaphalium polycephalum; variations described in paper 25 ..... HELEN GUHMAN
7. Thorns of honey locust, Gleditsia triacanthos ..... F. E. BEGHTEL
8. Twigs as a basis for winter tree study; a method of mounting, E. LUCY BRAUN
9. Rainfall and vegetation map of Asia ..... GEO. D. HUBBARD
10. Drawings of opalinids ..... MAYNARD M. METCALF
11. Distribution maps of opalinids and their hosts, illustrating papers 8 and 9 and contribution to symposium on geographical distribution, MAYNARD M. METCALF

THE TIME OF SEX DETERMINATION IN PLANTS.*

JOHN H. SCHAFFNER
Department of Botany, Ohio State University.

Having devoted a considerable number of years to cytological investigations, especially on the nature and activity of the chromosomes, and having in the meantime acquired some knowledge of the taxonomy of plants in general and of the nature of their sexual manifestations, the writer at length became aware of the fact that the problems of sex determination, sex differentiation, and sex reversal lie entirely outside of the phenomena of chromosome aggregations and segregations which occur at the fertilization and reduction division periods. Such a conclusion must be evident to anyone who compares a few plant life cycles in relation to these processes or makes a taxonomic study of a series of related plants with bisporangiate, monecious, or diecious flowers. The mere fact that sex determination and segregation usually do not at all coincide with fertilization or reduction in the higher plants and also not in most lower forms, and that such coincidence is confined to a comparatively few out of many types of sexual cycles, made it plain that those botanists who were seeking an explanation of sex determination and sex segregation in a Mendelian formula of homozygous and heterozygous chromosome or factor constitutions were not only following a delusion, but attempting to establish an hypothesis of sexuality that would result in nothing except a contradiction of the most evident phenomena.

A comparison of the various classes of plants from the lowest to the highest and a study of numerous life cycles indicate that practically all plants can be placed into three categories or evolutionary series in respect to their sexual states. The lowest plants are apparent without sex and above these are two groups, each one definitely determined by a transition line, giving two definite evolutionary series. The first transition is from the nonsexual plants to those with sexuality developed only in relation to the gametophyte. If a sporophyte is present

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no sexual states are normally manifest, the universal condition being a homosporous sporophyte individual. The second transition is from plants with sporophytes without sexual states to those with sporophytes showing sexual dimorphism at some stage of their development.

In respect to sex, therefore, all plants can be classified into three general groups. See Chart 1.

I. Plants entirely without sex.

II. Plants in which sexual states and sexual dimorphisms may arise in the gametes or gametophytes, but normally not in the sporophytes if such are present.

III. Plants in which sexual states and sexual dimorphisms arise in the sporophyte, the gametophytes also showing sexual dimorphism and normally always being unisexual.

In both types of sexual plants, so far as they are multicellular, there are numerous independent series of forms ranging from hermaphrodites to unisexual individuals on the one hand and from individuals with bisporangiate sporophylls or flowers to diecious individuals on the other. In both groups the beginning of the establishment of sexual states is near the end of the ontogeny, and in both evolution proceeds by the establishment of the sexual states at earlier and earlier periods in the ontogeny until finally the extreme cases are reached in the sexual state being determined on the one hand during the reduction division, and on the other in the fertilization period. It is self evident, therefore, that some unisexual gametophytes have their sex determined at reduction and others at the beginning of the preceding generation, namely, at fertilization or at some other stage of the sporophyte. Very commonly, and so far as we know perhaps all, unisexual gametophytes which have their sex determined at reduction may have their sexual state reversed to the opposite sex in either direction, and monosporangiate sporophytes which have their sex determined at fertilization may also have their sexual states reversed to the opposite sex in either direction.

In all normal cases sex determination arises but once in the life cycle even though there is an alternation of generations in which it would be possible for the sex to be determined independently for both the gametophyte and sporophyte,

were sex determination dependent on aggregation and segregation of chromosomes.

We can compare the determination of maleness and femaleness with the ordinary process of morphological determination in the ontogeny. In some plants and animals some change is brought about during the process of differentiation which interferes with regeneration so that no reproduction of the individual occurs. In others renewed activity and reproduction of the entire individual are initiated through unusual stimuli.

CHART I.

THE THREE SERIES OR STAGES OF PLANTS IN RELATION TO THE SEXUAL STATE.

Evolution of the sexual state in the sporophyte.	VII. ANGIOSPERMÆ VI. GYMNOSPERMÆ V. PTERIDOPHYTA HETEROSPORÆ	THIRD STAGE. Sexual plants with an alternation of generations, the gametophyte being completely unisexual and the sporophyte always showing some sexual dimorphism, and on all levels except the lowest showing phyletic series ranging from individuals with bisporangiate flowers to monecious and finally dieciou; individuals. Sexuality in the sporophyte attained independently in a number of groups.
Evolution of the sexual state in the gametophyte.	IV. PTERIDOPHYTA HOMOSPORÆ III. BRYOPHYTA II. NEMATOPHYTA	SECOND STAGE. Sexual plants with and without alternation of generations, only the gametes or gametophytes with sexual dimorphism, the sporophyte, when present, normally being in a neutral condition and homosporous, the gametophyte on all levels showing phyletic series from hermaphrodites to completely unisexual individuals. Sexuality attained independently in a number of groups.
Evolution of non-sexual plants.	I. PROTOPHYTA	FIRST STAGE. Plants without sex.

In still others differentiation changes the physiological state of the cell so little that regeneration and somatic reproduction are very general phenomena. Such reproduction often arises in cells highly differentiated morphologically, as when a protonema arises from a liverwort scale or from the diploid, sporophyte tissue of a moss.

Apparently there are similar processes which determine the sexual states in the cell. In some plants the sexual state is easily reversed; in other plants, both gametophytes and sporophytes, reversal is brought about with difficulty or not at all. In the egg or spore then in which sexual states are established, as well as in hermaphrodites, plants with bisporangiate flowers, and monecious plants, sexual states may be strongly or weakly established.

We do not need to be greatly concerned about the more or less equal numbers often maintained between the sexes, which seems to have been the main reason for the Mendelian hypotheses of sex. If we assume that at a certain stage the cell is in a condition of balance or equilibrium so that a slight change of environment, either external or internal, will throw the sexual state in one direction or the other the sex ratio should remain nearly equal. We necessarily are compelled to assume such physiological balances in any event when dealing with certain monecious types where, by a sex determination at a certain point and its reversal at a later stage, more or less constant numerical ratios result of the two types of flowers under a given environment, but which are entirely changed under a new environment. If a constant ratio can be maintained between dimorphic branches on a common axis through changing physiological states, it is not such a very serious challenge when the dimorphism appears in a similarly constant ratio between independent units. The writer has shown that in Arisaema triphyllum, for example, it would be possible to maintain almost any sex ratio desired by a simple environmental control. It is also established that in Cannabis sativa the percentage of sex reversal follows closely the relative length of daylight, so that the actual percentage of reversal for any light period may be predicted about as accurately as the ordinary sex ratios of the higher animals or of the diecious plants.

In those plants in which sexual states arise in the vegetative parts, which is the predominant type, the progression of internal environments, as cell lineage, senility, food supply, relation to more primary tissues, etc., usually are constant enough to put the plant through a regular cycle of sexual expression, just as is the case in the morphological expression, so that it is difficult to change the natural course of events. If, however, we take a plant which has developed an hereditary constitution that unsettles the cell in respect to its sexual states, then the sequence of sexual expression is easily reversed and the part of the flower which should produce stamens may produce carpels or vice versa. This is a common occurrence in such diecious plants as are just across the border line, evolutionally speaking, from the primitive and normal type of bisporangiate angiosperm flowers with the stamens develop first and the carpels above. Familiar examples are various species of Thalictrum, in which in case of reversal stamens or carpels may arise in any position, although the lower bisporangiate Thalictrums have the stamens and carpels in the normal positions, i. e., the stamens below and the carpels above.

In a paper* published by the writer in 1918, entitled "The Expression of Sexual Dimorphism in Heterosporous Sporophytes," the statement was made that: "The sexual state is thrown back, so to speak, into a small part of the sporophyte. It is this spreading of the sexual state, with an ever increasing area of tissue involved, that constitutes one of the most interesting aspects of sporophyte evolution in the higher plants." The evolution of the gametophyte, of course, proceeds in the same way. The difference between a plant with bisporangiate flowers and one with monecious or diecious flowers is a difference in hereditary constitution which induces a male or a female state to be established in the cells or to be reversed at an earlier or later stage of the ontogeny. It is the setting up of a particular physiological condition which activates or controls the expression of hereditary factors into male or female characters that constitutes the real problem to be investigated; and not a search for segregating or associating hereditary factors or "sex chromosomes."

*Ohio Jour. Sci. 18:101-125.

The following diagram (Diagram 1) represents graphically the principal stages of the life cycle of the archegoniates and seed plants at which sex determination or sex reversal takes place in various species. The successive stages show the actual evolutionary progression or phyletic series in relation to the sexual state. It is important to note that whether the gametophyte be hermaphroditic or unisexual, whether the sporophyte be homosporous or heterosporous, there is normally

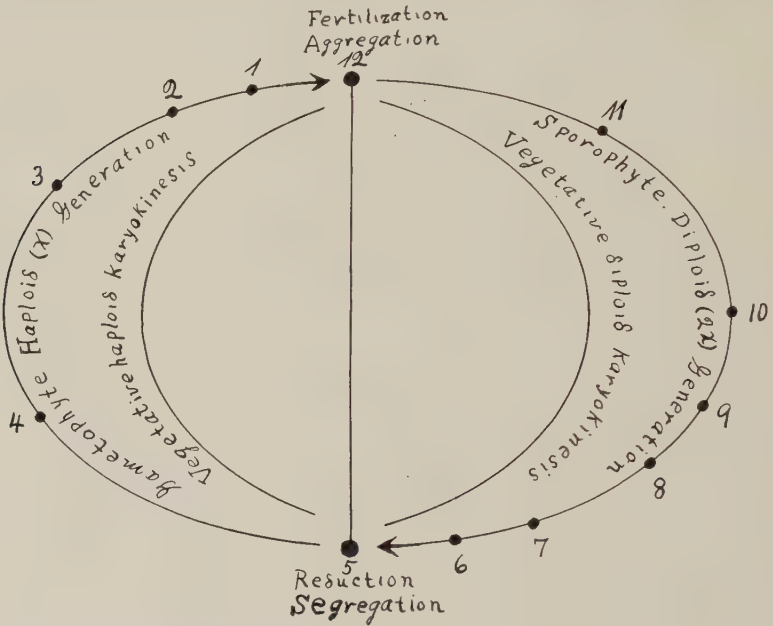

Diagram 1. Showing the various stages at which sex determination takes place in the life cycle in the main types of plants above the thallophytes.

but one stage of sex determination in the life cycle which may, however, be followed soon after by a complete sex reversal. If the sex is determined in the gametophyte there is none in the sporophyte, and if the sex is determined in the sporophyte it remains unchanged through the following gametophyte. The numbers in the diagram represent the following conditions:

1. The point at which sex is determined in plants with hermaphroditic gametophytes and homosporous sporophytes. The sex is determined near the end of the ontogeny of the gametophyte—synoicous, hermaphroditic gametophytes. The

antheridia and archegonia are commingled and sexual dimorphism can appear only in these structures, i. e., between stages 1 and 12.

2. The point at which sex is determined in plants with homosporous sporophytes and paroicous, hermaphroditic gametophytes. In this case sexual dimorphism may be present beyond the gametangia and the opposite sex is expressed farther up on the elongating axis. Sexual dimorphism can appear only between stages 2 and 12.

3. The point at which sex determination takes place in plants with homosporous sporophytes and autoicous, hermaphroditic gametophytes. Entire branches or tips of branches are determined with one sex or the other. Sexual dimorphism is possible between stages 3 and 12.

4. The point at which sex is determined in plants with homosporous sporophytes and with the extreme type of autoicous, hermaphroditic gametophytes in which large branches or branching systems have but one kind of sex organs. In various liverworts and mosses such branches often become separated, giving rise to apparently unisexual gametophytes. Sexual dimorphism may appear between 4 and 12.

5. Time of the reduction division or segregation of chromosomes. If sex determination takes place at this point the gametophytes become unisexual, with possible sex reversal later in the ontogeny of the gametophyte. The sporophyte remains homosporous. Sexual dimorphism is possible in the entire gametophyte, from 5 to 12.

6. The point at which the sexual state is first determined in the sporophyte—heterosporous plants with unisexual gametophytes. Sex determination takes place in the incipient megasporangia and microsporangia or in separate sori on the same leaf or in the floral axis, giving rise to dimorphic sporophylls in the same flower (bisporangiate flowers). Sexual dimorphism present between 6 to 5 to 12.

7. The point at which sex determination takes place in monecious plants with commingled staminate and carpellate flowers, the sex being established at the base of the floral axis. Sexual dimorphism present from 7 to 5 to 12.

8. The time at which sex determination first takes place and is later reversed in monecious plants having inflorescences

with maleness determined below and femaleness above or vice versa. Sexual dimorphism from 8 to 5 to 12.

9. The point at which sex determination takes place, in monecious plants, at the base of the inflorescence, normally without reversal. Sexual dimorphism possible from 9 to 5 to 12.

10. The point at which sex determination takes place in monecious plants having the sporophyte developed with large monosporangiate branches. Sexual dimorphism present to a greater or less degree from 10 to 5 to 12.

11. The point at which sex determination takes place in monecious plants with the main parts of the body differentiated into staminate and carpellate systems. Sexual dimorphism present to a greater or less degree from 11 to 5 to 12.

12. Time of fertilization, or aggregation of chromosomes. The time of sex determination in diecious plants. The sporophytes are entirely monosporangiate under normal conditions, either staminate or carpellate. The determination of the sexual state of the sporophyte and following gametophyte takes place in the egg before fertilization, during the fertilization period or in the early stages of the zygote. Sexual dimorphism is possible in the entire sporophyte individual as well as in the entire gametophyte, i. e., in the entire life cycle from 12 to 5 to 12.

There are, of course, all possible types of intergradation between these main stages. In most cases plants may have determination of sex at an earlier or later stage of development than the normal one. In some species, like Zea mays, there may be much variation, both through the operation of environmental factors and because of differences in hereditary constitution. There is also a possibility of sex reversal in most of the types, except apparently in the gametophytes of heterosporous plants and in a few lower unisexual gametophytes. Specific abnormalities also occur here and there, as for example, cases of apospory and apogamy.

By referring to the diagram it will be seen that at two points in the life cycle the time of sex determination coincides with chromosome shiftings, i. e., in those plants with monosporangiate, heterosporous sporophytes and unisexual gametophytes and in those plants with unisexual gametophytes and homosporous sporophytes. In the former it is possible to apply a homozygous-heterozygous allosome or sex factor formula, in the latter, a

haploid allosome or sex factor formula. The writer has shown by experiments on Cannabis, Humulus, Acnida, Thalictrum, and Arisaema that the homozygous-heterozygous hypothesis is not true, and Mrs. Dorothy Elizabeth Wuist Brown's* experiments with the Ostrich fern show that a segregation, or haploid sex formula, does not hold for unisexual gametophytes having homosporous sporophytes, since she was able to induce sex reversal in both the male and female thalli. The same conditions have been found for the unisexual gametophytes of Equisetum arvense. A glance at the diagram will show that no haploid, segregation allosome, or sex factor can hold for the unisexual gametophytes of heterosporous plants, since the sex is determined before reduction and both cells of the reduction division continue to have the same sex in the gametophyte.

But even if no conclusive experimental evidence were present to show that the hypothesis of Mendelian sex determination is a delusion, would it not be the mark of rashness to assume that the sex determination which takes place at the fertilization and reduction stages must be of a fundamentally different nature, with a new chemistry, physics, or physiology, than the exactly similar sex determination which takes place at the various other stages of the gametophyte and sporophyte ontogenies?

The writer does not at present wish to enter into a discussion of the problem as it affects the higher animals with an allosome difference, except to state positively that the elaborate scheme of sex formulae and nomenclature set up in the past few years has apparently no more foundation on which to rest in the animal kingdom than in the plant kingdom. The whole matter can be consistently explained in an entirely different way. Again, it is necessary to insist on some convincing evidence before the sexuality of plants and of the hermaphroditic animals is divorced from that of the higher unisexual animals.

In the case of an allosome difference it may be true that the difference in heredity between the two bodies may profoundly influence the functional activity of the cell and thus bring about one sexual state or the other, but if this is the case it is in the end only a mode of functional activity of the same nature as when sexual states are determined or reversed in organisms without an allosome difference.

*Wuist, Elizabeth Dorothy. Sex and Development of the Gametophytes of Onoclea struthiopteris, Physiol. Res. 1:93-132. 1913.

As stated above, in both the gametophyte generation of homosporous plants, including bryophytes and homosporous pteridophytes, and in the sporophyte generation of the heterosporous plants, including heterosporous pteridophytes, gymnosperms, and angiosperms, there are numerous repetitions of the evolutionary sequence of sexual states with various intergradations in each series. Thus it is in the gametophyte of the homosporous plants that sexuality is to be studied, since the sporophyte is normally neutral, while in the heterosporous plants, the gametophyte being unisexual, it is the sporophyte that shows the evolutionary progression of the determination of sexual states. In the first, the progression is repeated on practically all levels, the series running from hermaphrodites, often with closely associated organs of the two sexes, through various gradations as synoicous, paroicous, and autoicous, to distinctly unisexual individuals. It must be remembered that all these gradations arise in the presence of the haploid number of chromosomes. In the second, i. e., the hetersoporous sporophyte type, the gradation proceeds from the lowest stage with closely associated microsporangia and megasporangia in the same sorus, to differentiated sori, and then to the more typical bisporangiate flower with distinct microsporophylls and megasporophylls, and from this stage on through the various types of monecious plants to the typical diecious species. These gradations, duplicating those of the gametophyte, appear in the presence of the diploid number of chromosomes.

Below is given a characteristic list of plants, extending from the lower liverworts to the highest dicotyls. This representative list will clearly indicate the relation that exists between the different types of sexual expressions and their independence of aggregating and segregating, Mendelian hereditary units. Such examples could be extended indefinitely, but a study of these given should be sufficient to lead anyone to a comprehension of the real nature of sexuality and the nature of the problems to be solved. Seen in their proper light, they should also be able to clear the minds of any who may have become confused or befogged by the acceptance of the homozygous-heterozygous formula as an explanation of sexuality as it is actually developed in organisms.

Series of species of gametophytes of the homosporous higher plants and of sporophytes of the heterosporous plants to show the nature of the relation of the unisexual state of the individual to the bisexual state.

BRYOPHYTA.

I. Riccia group.—*Riccia crystallina* L., hermaphrodite; *R. michelii* Raddi, unisexual; *Ricciocarpus natans* (L.) Corda, hermaphrodite or apparently sometimes unisexual.

II. Marchantia group.—*Targionia hypophylla* L., hermaphrodite; *Reboulia hemispherica* (L.) Radi, individuals either hermaphrodite or unisexual; *Marchantia polymorpha* L., unisexual but occasionally hermaphroditic individuals have appeared; *Conocephalum conicum* (L.) Dum., unisexual.

III. *Sphaerocarpus terrestris* (Micheli) Sm., unisexual with an allosome difference.

IV. Metzgeria group.—*Metzgeria conjugata* Lindb., hermaphrodite; *M. pubescens* (Schrank) Raddi, unisexual.

V. Fosombronia group.—*Fosombronia foveolata* Lind., hermaphrodite (either synoicous or paroicous); *F. wondraczeki* (Corda) Dum., hermaphrodite (paroicous); *F. caespitiformis* De Not., hermaphrodite (paroicous) and unisexual; *F. angulosa* (Dicks.) Raddi, unisexual.

VI. Cephalozia group.—*Cephalozia bicuspidata* (L.) Dum., hermaphrodite (autoicous); *C. lammersiana* (Hueb.) Spruce, hermaphrodite (autoicous) or apparently unisexual by the separation of male and female branches; *C. serriflora* Lind. unisexual.

VII. Cephaloziella group.—*Cephaloziella elegans* (Heeg) K. M., hermaphrodite (paroicous); *C. striatula* (Jens.) Douin, hermaphrodite (autoicous but occasionally paroicous); *C. hampeana* (Nees) Schiffn., hermaphrodite (autoicous); *C. myriantha* (Lind.) Schiffn., hermaphrodite (paroicous) and occasionally pure male and female individuals produced; *C. starkei* (Funck) Schiffn., unisexual.

VIII. Frullania group.—*Frullania saxicola* Aust., hermaphrodite (autoicous); *F. tamarisci* (L.) Dum., this and most species of the genus unisexual.

IX. Bog-moss group.—*Sphagnum rigidum* Schp., hermaphrodite; *S. squarrosum* (Pers.) Schwaeg., either hermaphrodite or unisexual; *S. cymbifolium* Ehrh., unisexual.

X. Granite Moss group.—*Andreaea petrophila* Ehrh., hermaphrodite (autoicous); *A. nivalis* Hook., unisexual.

XI. Grimmia group.—*Grimmia apocarpa* (L.) Hedw., hermaphrodite (autoicous); *G. alpestris* Schleich., unisexual or rarely hermaphroditic (autoicous); *G. trichophylla* Grev., unisexual.

XII. Bryum group.—*Bryum arcticum* R. Br., hermaphrodite (synoicous); *B. provinciale* Philib., hermaphrodite, often synoicous and autoicous branches on the same plant; *B. warneum* Bland, hermaphrodite

(autoicous, rarely synoicous); *B. marratti* Wils., hermaphrodite (autoicus); *B. roseum* Schreb., unisexual.

XIII. Hypuum group.—*Hypuum polygamum* Schp., hermaphrodite (synoicous or autoicous); *H. riparium* L. hermaphrodite (autoicous); *H. exannulatum* Guemb., unisexual, rarely hermaphroditic (autoicous); *H. aduncum* Hedw., unisexual.

XIV. Splachnum group.—*Splachnum ampullaceum* L., hermaphrodite (autoicous); *S. vasculosum* L., unisexual.

XV. Hair-cap Moss group.—*Catharinaea undulata* Web. & Mohr., hermaphrodite (synoicous and paroicous); *C. tenella* Roehl., unisexual; *Polytrichum commune* L., unisexual. The tendency in the higher mosses is to be unisexual.

Pteridophyta Homosporæ.

XVI. Eusporangiate ferns.—*Botrychium virginianum* (L.) Sw., hermaphrodite; *Marattia douglasii* (Presl) Baker, usually hermaphroditic, but sometimes thalli appear with only antheridia present.

XVII. Leptosporangiate ferns.—*Adiantum capillus-veneris* L., hermaphrodite; antheridia develop first and later toward the anterior end an area of archegonia is developed; *Pteretis nodulosa* (Mx.) Nieuwl., American Ostrich-fern. (*Onoclea struthiopteris* L. of authors), typically unisexual. According to the investigations of Mrs. Elizabeth Dorothy Wuist Brown, about 15% of the thalli in old cultures in soil were hermaphroditic. She was able to induce 90% of the female thalli later to produce antheridia. Only 5% of the male thalli were induced later to produce archegonia.

XVIII. Equisetum.—*Equisetum laevigatum* A. Br., thalli hermaphroditic, *E. arvense* L., thalli unisexual with sex reversal in both directions, but more commonly the females changing to the male condition. Note: So far as known, in both the leptosporangiate ferns and in the horsetails, the unisexual thalli occur in the species with the most highly evolved sporophytes.

XIX. Lycopods.—*Lycopodium complanatum* L., has hermaphroditic gametophytes.

Heterosporous Sporophyte Series, the Gametophytes Being Unisexual.

XX. Heterosporous Pteridophytes.—*Marsilea quadrifolia* L., microsporangia and megasporangia in the same sorus; *Salvinia natans* (L.) Hoff., microsporangia and megasporangia in distinct sori on the same leaf; *Selaginella rupestris* (L.) Spring., microsporangia and megasporangia on distinct sporophylls, but on the same floral axis; i. e., flowers bisporangiate.

Angiospermæ.

XXI. The Lowest Helobiæ.—*Echinodorus cordifolius* (L.) Griseb., flowers bisporangiate; *Lophotocarpus calycinus* (Engelm.) Sm., bispor-

angiate in lower part of inflorescence, staminate with vestigial carpels in the upper part; *Sagittaria longirostris* (Micheli) Sm., monecious, with carpellate flowers below and staminate above or sometimes the entire inflorescence staminate or carpellate; doubtful whether there are really diecious individuals; *Burnatia enneandra* (Hochst.) Micheli, diecious.

XXII. Palms.—*Sabal palmetto* (Walt.) R. & S., flowers bisporangiate; *Cocos nucifera* L., monecious, the staminate and carpellate flowers on the same inflorescence with occasional intermediate flowers on the transition tissue; *Phoenix dactylifera* L., diecious, but occasionally with sex reversal at least on the staminate plant. Note: Palms of all gradations of sexual expression occur between the bisporangiate and diecious types.

XXIII. Aroids.—*Acorus calamus* L., flowers bisporangiate; *Peltandra virginica* (L.) Kunth., monecious, with a transition zone between the carpellate flowers below and the staminate above; *Ariseama dracontium* (L.) Schott., monecious and staminate individuals, the staminate usually greatly predominating; monecious individuals ranging from those having only a few carpellate flowers below to those with only a few staminate flowers above; sex reversal of both types general, the staminate to monecious, and the monecious to staminate; *Arisaema triphyllum* (L.) Torr., diecious, with a considerable percentage of monecious individuals ranging from almost completely staminate; to almost completely carpellate sex reversal in all types of individuals general in all directions.

XXIV. Sedges.—*Scirpus validus* Vahl., flowers bisporangiate; *Cymophyllus fraseri* (Andr.) Mackenz., monecious, the spikelet carpellate below and staminate above; *Carex gracillima* Schwein., monecious, spikelets staminate below, carpellate above; *C. lupulina* Muhl., monecious, the entire spikelets are either carpellate or staminate; *C. exilis* Dewey, sometimes diecious, sometimes with staminate flowers above and carpellate flowers below, and sometimes with carpellate flowers above and staminate below; *C. dioica* L., diecious.

XXV. Grasses.—*Festuca elatior* L., flowers bisporangiate; *Panicum virgatum* L. Spikelets with a bisporangiate and a staminate flower; *Andropogon furcatus* Muhl., with paired spikelets, one with a bisporangiate flower, the other with a staminate flower; *Zizaniopsis miliacea* (Mx.) D. & A., monecious, the panicle with carpellate spikelets and staminate spikelets, the carpellate borne at the base of the branches and the staminate at the ends; *Zizania aquatica* L., monecious, staminate spikelets in the lower part of the panicle, and carpellate spikelets at the upper end, with spikelets containing bisporangiate flowers on the transition zone; *Tripsacum dactyloides* L., monecious, the lower part of the inflorescence with carpellate spikelets and the upper with staminate spikelets; *Zea mays* L., monecious, normally with completely distinct staminate and carpellate inflorescences, but often with many intermediate developments; *Scleropogon karwinskyanus* (Fourn.) Benth., diecious; *Bulbilis dactyloides* (Nutt.) Raf., diecious, but apparently monecious individuals have been reported.

XXVI. Bunch-flower sub-family.—*Anticlea elegans* (Pursh) Rydb., flowers bisporangiate; *Zygadenus glaberrimus* Mx., flowers mostly bisporangiate; *Stenanthium robustum* Wats., inflorescence with bisporangiate and monosporangiate flowers; *Melanthium latifolium* Desr., monecious, both sorts of flowers scattered in the same inflorescence, probably with some intermediate flowers; *Chamaelirium luteum* (L.) Gr., diecious.

XXVII. Thalictrum group.—*Thalictrum clavatum* DC., flowers bisporangiate; *T. dasycarpum* Fisch. & Lall., flowers bisporangiate or monosporangiate, plants monecious to diecious with change of sexual expression in the individual from time to time; *T. revolutum* DC., diecious or some plants with both stamens and carpels; *T. dioicum* L., diecious, with occasional individuals of various grades of intermediateness.

XXVIII. Clematis group of genera.—*Atragene americana* Sims, flowers bisporangiate; *Clematis virginiana* L., diecious with some intermediate flowers occasionally present.

XXIX. Spurge group.—*Geranium maculatum* L., flowers bisporangiate; *Callitriche austeni* Engelm., with bisporangiate and monosporangiate flowers; *Croton monanthogynus* Mx., monecious with commingled flowers; *Ricinus communis* L., monecious with staminate flowers on the lower part of the panicle and carpellate flowers above; occasionally with bisporangiate flowers on the transition zone; *Stillingia sylvatica* L., monecious, with carpellate flowers below and staminate above; *Chamaesyce maculata* (L.) Small, monecious, with reduced carpellate and staminate flowers close together in a cyathium; *Mercurialis annua* L., diecious with some intermediate individuals; *Croton texensis* (Klotzsch) Muell., diecious, with considerable vegetative sexual dimorphism.

XXX. Amaranth group.—*Froelichia campestris* Small, flowers bisporangiate; *Amaranthus spinosus* L., monecious; *Amaranthus palmeri* Wats., diecious, with intermediates; *Acnida tamariscina* (Nutt.) Wood; diecious, with occasional sex reversal in both staminate and carpellate plants.

XXXI. Rumex group.—*Oxyria digyna* (L.) Hill, flowers bisporangiate; *Rumex crispus* L., with bisporangiate and carpellate flowers on the same plant; *Rumex altissimus* Wood., monecious with vestiges in both the staminate and carpellate flowers; *Rumex acetosella* L., diecious.

XXXII. Rose family.—*Duchesnea indica* (Andr.) Focke, flowers bisporangiate; *Poterium sanguisorba* L., with bisporangiate and monosporangiate flowers in the heads; *Fragaria vesca* L., diecious, with monecious individuals; *Aruncus aruncus* (L.) Karst., diecious.

XXXIII. Bean family.—*Hoffmanseggia jamesii* T. & G., flowers bisporangiate; *Gleditsia triacanthos* L., with bisporangiate and monosporangiate flowers; *Gymnocladus dioica* (L.) Koch, diecious, both flowers with prominent vestiges.

XXXIV. Maple group.—*Staphylea trifolia* L., flowers bisporangiate; *Aesculus glabra* Willd., monecious, both flowers in the same

cluster; *Acer platanoides* L., diecious, with frequent reversals of flowers or branches to the opposite sex; *A. saccharinum* L., diecious, with sex reversal in both directions; *A. negundo* L., diecious.

XXXV. Nettle group.—*Ulmus americana* L., flowers bisporangiate; *Parietaria pennsylvanica* Muhl., with bisporangiate and monosporangiate flowers; *Humulus japonicus* Sieb. & Zucc., diecious, with sex reversal in either direction; *Cannabis sativa* L., diecious, with no vestiges in the flowers but with distinct vegetative dimorphism, some races with monecious individuals, mostly with abundant sex reversal in either direction under proper environment, especially under short light periods alternating with long periods of darkness.

XXXVI. Woody amentifers.—*Alnus incana* (L.) Willd., monecious; *Myrica gale* L., diecious, with sex intermediates and with sex reversal in either direction; *Salix amygdaloides* Anders., diecious with occasional monecious individuals; *Populus deltoides* Marsh., diecious.

XXXVII. Evening primrose type.—*Oenothera biennis* L., flowers bisporangiate; *Proserpinaca palustris* L., flowers bisporangiate; *Myriophyllum heterophyllum* Mx., monecious, with carpellate flowers below and staminate above on the inflorescence and with bisporangiate flowers on the transition zone; *Myriophyllum proserpinacoides* Gill., is said to be nearly diecious; *Fuchsia procumbens* Cunn., diecious.

XXXVIII. Cucurbit group.—*Asarum canadense* L., flowers bisporangiate; *Cucumis melo* L., monecious, but often with some functional bisporangiate flowers; *Cucurbita foetidissima* H. B. K., monecious; *Sicyos angulatus* L., monecious, staminate and carpellate inflorescence arising from the same node; *Bryonia alba* L., monecious; *Bryonia dioica* L., diecious.

XXXIX. Ebony group.—*Bumelia lycioides* (L.) Pers., flowers bisporangiate; *Symplocos tinctoria* (L.) L'Her., with bisporangiate and staminate flowers; *Diospyros virginiana* L., diecious.

XL. Fraxinus group.—*Syringa vulgaris* L., flowers bisporangiate; *Fraxinus ornus* L., flowers bisporangiate or imperfectly bisporangiate; *F. quadrangulata* Mx., flowers bisporangiate or imperfectly bisporangiate; *F. americana* L., diecious.

XLI. Plantain group.—*Plantago rugelii* Decne., flowers bisporangiate; *Littorella uniflora* (L.) Asch., monecious, with decided dimorphism of the peduncle; *Plantago heterophylla* Nutt., diecious, with some bisporangiate flowers; *P. virginica* L., diecious.

XLII. Valeriana.—*Valeriana pubicarpa* Rydb., flowers bisporangiate; *V. edulis* Nutt., imperfectly diecious, with bisporangiate and monosporangiate flowers; *V. acutiloba* Rydb., diecious and dimorphic.

XLIII. Ragweed group.—*Iva ciliata* Willd., monecious, marginal flowers of the heads carpellate, central flowers staminate; *Ambrosia trifida* L., monecious, carpellate heads below, staminate heads above.

XLIV. Composits.—*Lacinaria scariosa* (L.) Hill, flowers bisporangiate; *Inula helenium* L., outer, ray flowers carpellate, inner, disk

flowers bisporangiate; *Silphium perfoliatum* L., monecious, outer flowers carpellate and inner staminate; *Baccharis salicina* T. & G., diecious; *Antennaria plantaginifolia* (L.) Rich., diecious, with dimorphic inflorescence.

XLV. Genus Artemisia.—*Artemisia tridentata* Nutt., all the flowers bisporangiate; *A. absinthium* L., marginal flowers carpellate, central flowers bisporangiate; *A. caudata* Mx., marginal flowers carpellate, central flowers staminate.

XLVI. Genus Cirsium.—*Cirsium undulatum* (Nutt.) Spreng., flowers bisporangiate; *C. arvense* (L.) Scop., diecious or imperfectly diecious.

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DIPTERA OF THE FAMILY DOLICHOPODIDAE.

M. C. VAN DUZEE

Campsicnemus clandicans, Loew.

Nine males and thirty-six females were taken at Kodiak, June, 1917, and Savonoski, Naknek Lake, in July, 1919. This species was described from Alaska, Dr. Aldrich has reported it from Idaho.

Campsicnemus degener, Wheeler.

Four males were taken at Savonoski, Naknek Lake, Alaska, in July, 1919. This species has been taken only in California and Idaho as far as known to me, it is interesting to find it in Alaska.

Porphyrops consobrina, Zett.

Fifteen males and ten females taken in Alaska in June and July, 1917, and 1919, at Katmai, and Savonoski, Naknek Lake.

Coquillett reported this species from Alaska in 1900, Dr. Aldrich in his Catalogue of Diptera, 1905, in a note says the determination of this species seem to be premature, but I have compared these Alaska specimens with Dr. Lundbeck's description of that species and cannot see where there can be any doubt of its identity. Am giving below the characters that distinguish the species.

Face narrow, silvery white. Palpi black. Beard yellowish white. Third antennal joint nearly twice as long as the two basal joints taken together; arista shorter or about as long as the antenna. Hypopygium with its outer lamellæ (Fig. 1 a) short, blackish, the apical part somewhat triangular, about as long as wide, and about as long as the stem, which is rather broad; inner appendages (Fig. 1 b) black, lanceolate, nearly as long as the outer lamella. All coxæ black with long pale hair; middle pair without a spine at tip. All femora black with yellow tips; posterior pair with one or two preapical bristles; middle pair with long white hair below at base and a few black bristles on each

side at tip; fore femora thickest in the middle, with long black bristles below for their entire length, these are as long as the width of the femora, on the posterior surface there are long pale hairs, but the upper row of long hairs is black. Hind tibiæ black with the upper edge yellow almost to the tip, or yellowish with the tip broadly black, its bristles short. Fore and middle tibiæ pale yellow with strong bristles. Fore tarsi (Fig. 1) as long as their tibiæ, the first joint fully as long as second, slightly widened below and with a row of stiff black hairs above and below, second joint very slightly enlarged at base, or I might say slightly narrowed just beyond the base below, last three joints taken together but little longer than the first, fifth nearly as long as the third and fourth together. Hind basitars about (sometimes scarcely) as long as second joint.

Wings grayish hyaline; third vein with a gentle and even curve; last section of fourth vein a little bent at its middle, nearly parallel with the third at tip and ending in the apex of the wing; last section of fifth vein a little longer than the cross-vein; hind margin of wing nearly evenly rounded, still a little expanded basilly from the tip of fifth vein.

Porphyrops elegantula, Meig.

Four males and seven females were taken at Savonoski, Naknek Lake, Alaska, in July, 1919.

The male of this large fine Europian species is easily distinguished by its bright metallic color, the sixth abdominal segment being steel blue or violet. The outer lamellæ of the hypopygium (Fig. 2) are long, simple, narrow, pointed and of a yellowish or light brown color. Inner appendages black and slightly spoon-shaped, as long as the width of the hypopygium. Both the middle and hind coxæ have black spines at their tip, those on hind coxæ the shortest. Femora yellow; the posterior pair with black tips and two preapical bristles. Fore basitarsi expanded at tip below, as long as the two following joints taken together. Arista as long or a little longer than the antenna. Face silvery white, narrow, palpi grayish or yellow, third vein gently arched; last section of fourth vein nearly straight.

Porphyrops crassipes, Meig.

Two males and two females were taken at Savonoski, Naknek Lake, Alaska, in July, 1919.

There can be no doubt of this determination, it is an interesting species the distinguishing characters of which are:

Face narrow, silvery white. Beard white, abundant. Arista longer than the antennæ. Hypopygium with the outer lamellæ yellowish, very long and slender, forked near the middle, one branch shorter than the other. Fore and hind femora black, the latter considerably thickened, with a preapical bristle. Fore coxæ blackish with long white

hair; posterior pair with a tuft of black bristles at tip (not forming a spine); middle pair without a spine at tip. Middle femora mostly yellow, blackened at base only; their tibiæ and tarsi yellow, last two joints of the tarsi (Fig. 3) black, compressed and widened, forming together an oval tip to the tarsi, which is not much longer than wide, the fourth joint shorter than the fifth. Fore femora with long white hair on the posterior surface; fore tarsus as in Fig. 3 a, middle ones with some white hairs at base below. Wings rather broad, widest between the tips of fifth and sixth veins, the hind margin sinuous; last section of fourth vein and the third vein much bent so that they are much further apart near the middle of last section of fourth than at their tips.

Porphyrops tricaudata, new species.

Male: Length, 4 mm.; of wing the same. Face very narrow, silvery white. Palpi black. Front green. Antennæ black; third joint about twice as long as the two basal joints taken together. Arista about as long as the antenna. Orbital cilia black, descending to upper third of the eye. Beard abundant, whitish; eyes with white hair.

Thorax and abdomen green, a little dulled with grayish pollen, the former with the usual two dark lines in front. Hypopygium (Fig. 4) black with its outer lamellæ divided into three long branches, the posterior one the shortest; they are brownish, fringed with long pale hairs; inner appendages black, straight, styliform.

Coxæ and femora black; fore and middle femora yellow at tip. Fore coxæ with long white hair on its anterior surface, without black ones at tip. Middle and hind coxæ with less abundant white hair, without a spine at tip. Fore femora with rather long pale hair on posterior surface, those near the tip black and bristle-like. Middle femora with long white hairs below on basal half and several black bristles on each side at tip. Hind femora with one or two preapical bristles. Tibiæ yellow; fore and middle ones each with two rows of long bristles; posterior pair a little blackened at tip, its bristles rather strong, but shorter than on the other tibiæ. Fore tarsi (Fig. 4 a) longer than their tibiæ, the first two joints and base of third yellow, last three joints black; first joint thickened at tip, as long as second, second a little excavated below near the base and slightly so before the tip; first and basal half of second joint with a row of minute blunt spines below; third and fifth joints of nearly equal length, fourth a little shorter; middle tarsi yellow with last two joints black, of nearly equal length, slightly compressed, so that the fifth is twice as wide as the third. Hind tarsi brown, only the last two joints black, first scarcely longer than the second and about equal to the third and fourth taken together; fifth joint but little longer than wide. Calypters, their cilia and the halteres yellow.

Wings grayish; third vein gently and evenly arched; last section of fourth vein a little bent just beyond its middle, nearly parallel with third towards its tip, ending in the apex of the wing; last section of fifth

vein scarcely twice as long as the cross-vein; hind margin of wing nearly evenly rounded.

Female: Face wide, gray, the ground color sometimes showing through on the lower part, which is somewhat rounded in outline below; suture just below the middle of the face. Antennæ black, small, third joint about as long as wide, scarcely pointed at tip, arista nearly three times as long as the antenna. Front opaque with gray pollen. Beard yellowish white. Palpi large, obtusely pointed, black with black hair and white pollen. Fore coxæ more or less yellowish with rather long white hair; I see two black hairs at tip in some specimens. Femora and tibiæ yellow; posterior femora and tibiæ blackened at tips. Fore femora with a row of rather long black hairs on upper posterior edge, ending in several slender bristles. Middle and hind femora each with one or more preapical bristles. Fore and middle tarsi darkened from the tip of first joint, still only the apical joints black, both with their joints normal, the first joint being nearly as long as the following three joints taken together. Hind tarsi about as in the male. Wings as in the male, except that the last section of fifth vein is fully twice as long as the cross-vein.

Described from one male and seven females, taken at Savonoski, Naknek, Lake Alaska, in June and July, 1919, and two females from Katmai, Alaska, in August, 1917.

This is very much like *tridactyla* Frey, from Lapland. The male differs in having the inner appendages of the hypopygium nearly straight and not enlarged at tip; and in having the hind tibiæ largely yellow.

The outer lamellæ are also very slightly different from his drawing of those of *tridactyla*. The female differs in having the tips of the hind femora broadly black on upper and lateral surfaces. The front nearly opaque with white pollen, and the last two joints of middle tarsi not widened.

Porphyrops sp.

One female from Katmai, Alaska, July, 1917.

Has the face with brownish pollen, antennæ short, third joint as wide as long, the arista about three times as long as the antennæ; beard long, yellowish. Fore coxæ with very long yellow hair, no black ones at tip; fore femora black at base with whitish hairs below on basal half and long black ones on apical two-thirds of posterior surface; fore tarsi longer than their tibiæ, black from the tip of the first joint, the first joint scarcely as long as the two following joints together; third and fourth veins of the wing gently bent; last section of fifth vein fully twice as long as the cross-vein.

Porphyrops sp.

Four females from Savonoski, Naknek Lake, Alaska, taken in June and July, 1919.

Face with the suture near the middle, its pollen yellowish, lower part somewhat metallic. Antennæ short, arista about three times as long as the antenna. Hair on fore coxæ moderate long, yellowish white, no black ones at tip; fore femora yellow with a row of black hairs on upper posterior edge, ending on two bristles; fore tarsi longer than their tibiæ, blackened from the tip of the first joint, which is as long as the two following taken together; middle femora with several, hind ones with one preapical bristle. Third vein nearly straight; last section of fourth vein a little bent at its middle; last section of fifth vein nearly twice as long as the cross-vein.

Porphyrops nigra, new species.

Male: Length, 4 mm.; of wing, 3.7 mm. Face very narrow, black. Palpi black. Front opaque black; eyes with brown hairs. Antennæ black; third joint about as long as the two basal joints taken together; arista about equal to the antenna in length. Hairs of the beard mixed black and brownish.

Thorax black, scarcely at all greenish on the dorsum, which is dulled with brown pollen. Abdomen dark green, the apical segments almost black. Hypopygium black; its outer lamellæ very broad at base (Fig. 5 a), forked, one branch wide, short and blunt, the other long, rather narrow and more pointed; they are brownish; inner appendages (Fig. 5 b) yellow, black at upper corner, enlarged and truncate at tip, fringed with pale hairs. Coxæ black with long black hairs; middle pair with a long black thorn at tip. Femora black, a little yellowish at tip fore femora with long black hair on posterior surface; middle femora with long black hair below and three slender bristles on posterior side and one on anterior side at tip; hind femora with long black hair below, which is a little longer towards their tips. Fore tibiæ more than half black; middle pair yellowish, blackened on basal half above, four anterior tibiæ with strong bristles; hind tibiæ dark yellow, scarcely darker at tip, but dark at base, thickened towards the tip, their bristles stout. Fore tarsi (Fig. 5) one and a fourth times as long as their tibia, black from the tip of the first joint, still the base of the second joint a very little yellow, first joint as long as second, a very little thickened at tip, second joint abruptly narrowed near the base, both these joints with minute blunt black spines below, the three apical joints of nearly equal length. Middle tarsi with the two first joints yellow, the second half as long as the first (other joints missing). Hind tarsi black, second joint shorter than the first and fifth, only slightly shorter than the fourth. Calypters and halteres yellow, the former with black cilia.

Wings dark gray, with black veins; third vein considerably but evenly arched; last section of fourth vein only slightly bent near apical

third, ending slightly back of the apex of the wing; last section of fifth vein about twice as long as the cross-vein; hind margin of wing nearly evenly rounded.

Female: A female that I think belongs with the male described above, although not taken at the same place or in the same year, has the wing about as in the male, except that they are a little darker with a slightly hyaline spot around the cross-vein; the bend in the last section of the fourth vein is a little nearer its center, but otherwise about the same; it ends just back of the apex of the wing as in the male. The face is gray with the suture near its center; palpi black with black hairs; beard whitish; front, thorax and abdomen green with gray pollen; coxæ with long white hairs. Femora black with yellowish tips; fore femora with long white hair on the posterior surface; middle and hind ones with pale hairs below, the latter with a row of slender black bristles on lower outer edge; middle femora with two bristles on each side at tip; fore and middle tibiæ yellow, hind ones like those of the male; fore and middle tarsi as long as their tibiæ, darkened from the tip of the first joint, which is as long as the three following taken together.

Described from one male taken at Katmai, Alaska, in July, 1917; and one female taken at Savonoski, Naknek Lake, Alaska, in June, 1919.

Porphyrops borealis, new species.

Male: Length 4–4.5 mm.; of wing, 3.3–4 mm. Face narrow, black. Palpi black. Front green, nearly covered with white pollen. Antennæ black; third joint scarcely longer than the two basal joints taken together; arista about as long as the antennæ. Beard black, sometimes more brown. Eyes with pale hairs.

Thorax and abdomen green with whitish pollen, the former quite shining. Hypopygium (Fig. 6) black; its outer lamellæ long and narrow, yellowish brown, plain, as long as the height of the hypopygium and fringed with long pale hairs; the inner appendages very small, black, with a hair at tip.

Coxæ black with black hair, the middle pair with a black thorn at tip. Femora black; anterior pair with long black hair on their posterior surface; middle pair with several black bristles on each side near the tip; posterior pair with two preapical bristles. Fore and middle tibiæ yellow, the former with two, the latter with three rows of long bristles. Hind tibiæ blackish or yellowish brown with a yellow glabrous line on upper surface, and with two rows of rather stout bristles. Fore tarsi longer than their tibiæ, darkened from the tip of the first joint, which is about twice as long as the second and a little enlarged at tip; last three joints of about equal length. Middle tarsi black from the tip of the first joint, slightly longer than their tibiæ; the first joint nearly as long as the three following taken together, fourth scarcely longer than the fifth. Hind tarsi black, each joint a little longer than the one

following it. Halteres yellow. Calypters dark yellow with yellowish cilia, which appears black in certain lights.

Wings grayish; third vein considerably but evenly arched; last section of fourth vein bent near its middle, ending in the apex of the wing; last section of fifth vein scarcely twice as long as the cross-vein; hind margin of the wing rather evenly rounded.

Female: What seems to be the female of this species has the face gray; the suture below the middle, making the lower part of the face small; it is a little pointed at the center of its lower edge; palpi black, rather small, their tips yellowish; beard white, scanty; fore coxæ with yellow hairs, sometimes with one or more black hairs at tip; femora and tibiæ yellow; hind femora more or less black at tip or along the upper edge; middle and hind femora with preapical bristles; fore tarsi scarcely as long as their tibiæ, the first joint as long as the remaining four taken together; middle tarsi fully as long as their tibiæ, first joint as long as the three following joints taken together; hind tarsi black, first and second joints of nearly equal length. Wings gray; slightly brownish in front of second vein; third vein very slightly recurved at tip; last section of fifth vein more than twice as long as the cross-vein.

Described from six males and eight females, taken at Savonoski, Naknek Lake, Alaska, in June and July, 1919, and two males taken at Katmai, Alaska, in July, 1917 and two males taken by J. M. Aldrich at Anchorage, Alaska, July 20, 1921

Xiphandrium femoratum, new species.

Male: Third antennal joint band-like, as long as the height of the head, its arista about one-third of the length of the third joint. All coxæ black, the fore pair more or less yellow on apical half, their anterior surface with long silvery white hairs. Fore femora, except extreme base and tip, and apical third or more of hind femora black; middle femora yellow. The four anterior tibiæ yellow; hind tibiæ and their tarsi wholly black. Outer hypopyginal lamellæ elongate, slender triangles with a slender stem; inner appendages somewhat shovel-shaped, not at all clubbed, rather obliquely truncate at apex.

Four males were taken at Kodiak, Alaska, in June, 1917, and one female at Katmai, Alaska, in Augusta, 1917.

This is more fully described in transaction of the American Entomological Society, Vol. xlviii, p. 81

Since sending off the specimens I have decided to place as a distinct variety a form of this that has a thumb-like projection on the inner appendages near the middle of their length, calling it var. *pollex*, both are found in the Alaska material, as also in my Wells, Nevada, material.

Sympycnus aurifacies, Van Duzee

Male: Length, 1.7 mm.; of wing, 2 mm. Face narrow, golden yellow. Front dark blue or violet. Palpi yellowish, very small. Two basal joints of the antennæ orange yellow; third joint black, twice as long as wide, rather pointed at tip. Lower orbital cilia white, short.

Thorax greenish brown; dorsum with a median green line and a poorly defined purple stripe on each side of the line, sometimes the dorsum is so thickly covered with brown pollen as to conceal these lines; scutellum blue or violet, green around the edges, with one pair of large bristles. Abdomen short, depressed, bronze green, dull, its hairs black. Hypopygium almost entirely concealed. Fore coxæ wholly yellow, appearing bare, but with a few minute yellowish hairs. Middle and hind coxæ blackish. Femora and tibiæ wholly yellow and with very short hairs, those on the sides and lower surface of the femora are yellow and so minute that they appear bare. Middle femora with a small bristle on each side near the tip; hind pair with one preapical bristle. All tibiæ with a few very small bristles. All tarsi black from the tip of the first joint; anterior pair about one and a half times as long as their tibiæ, the first joint nearly as long as the two following joints taken together; the last three joints each a very little longer than the following joint. Middle and hind tarsi scarcely as long as their tibiæ; hind basitarsus scarcely as long as the following joint. Calypters, their cilia and the halteres yellow.

Wings tinged with brownish gray, veins black; fourth vein ending in the apex of the wing; last section of fifth vein twice as long as the cross-vein.

Female: Face nearly twice as wide as in the male, golden yellow; upper edge of first two antennal joints black, third joint black, smaller than in the male. Fore coxæ blackened on the front surface at base, sometimes almost to their tips; hairs on fore coxæ and legs a little longer than in the male, those on the sides of the femora mostly black; posterior knees very slightly blackened. Wings as in the male.

Described from three males and five females, taken at Savonoski, Naknek Lake, Alaska, in July, 1919.

Medeterus viridifacies, new species.

Male: Length, 3 mm. Face bright green, but not shining, with a transverse band of gray pollen across its center. Palpi large, black. Front opaque brown. First two antennal joints yellow, third black, small. Lateral and inferior orbital cilia yellowish.

Thorax brown, dorsum opaque with brown pollen; pleuræ more tinged with green; scutellum with four large bristles; acrostichal bristles small; three black bristles above fore coxæ. Abdomen black, quite shining. Hypopygium black, rather small, its appendages black.

Legs and feet altogether black; fore coxæ with a row of black bristles on outer anterior edge; hairs on the legs very minute; second joint of hind tarsi about one and a fourth times as long as the first. Calypters yellow, with a black edge and black cilia; halteres black.

Wings a little grayish; veins black, fourth and fifth veins more brown; last section of fifth vein nearly reaches the wing margin and is one and a fourth times as long as the cross-vein.

In the female the thorax is more shining than in the male.

Described from two males and one female; they were taken at Savonoski, Naknek Lake, Alaska, the males in July and the female in June.

Medeterus bicolor, new species.

Male: Length, 2.5–2.7 mm. Face dark green, with bronze reflections to nearly black. Palpi black. Front nearly opaque with brown pollen. Lower orbital cilia white. Antennæ wholly black, third joint small, a little pointed at tip.

Thorax slightly greenish; dorsum with brown pollen, which is more grayish white on its margins. Acrostichal bristles distinct; bristles above the fore coxæ small, black; scutellum with four large bristles, the median pair the longest. Abdomen dark green, almost black, shining, its hairs yellow. Hypopygium black with yellow appendages.

Fore coxæ with pale hairs on their anterior surface. Legs and feet black, knees yellow. Middle femora with long yellowish white hairs below for their entire length; hind pair with a row of black hairs or slender bristles on outer surface which are longest near the tip. Hind tarsi with the second joint nearly one and three-fourths times as long as the first. Calypters yellow with a brown edge and yellow cilia. Halteres yellow.

Wings grayish; costa black, veins brown; last section of fifth vein nearly reaching the wing margin and scarcely twice as long as the cross-vein.

Female: About as in the male, except that the second joint of hind tarsi is only about one and a half times as long as the first and the last section of the fifth vein is a little shorter.

Described from four males and five females taken at Savonoski, Naknek Lake, Alaska, in June and July, 1919.

Medeterus parvus, new species.

Male: Length, 2.5 mm. Face, head, thorax, abdomen and legs about as in *bicolor*, except that the second joint of hind tarsi is only about one-third longer than the first joint; the middle femora are without the long yellow bristles below, and the hind femora have a row of bristle-like hairs on lower outer edge and a row of several slender black bristles above them on outer surface. It also has the wings a little narrower near the base, the cross-vein shorter, making the last section of fifth vein fully twice as long as the cross-vein. The second joint of hind tarsi nearly one and a third times as long as the first.

Described from one male and two females, all from Savonoski, Naknek Lake, Alaska, taken in June, 1919.

TABLE OF NORTH AMERICAN SPECIES OF HYDROPHORUS.

1. Knobs of the halteres wholly yellow....2
   Knobs of halteres infuscated, at least on outer surface....21
2. Postvertical bristles in a row of six or more....3
   Postvertical bristles only two as usual....7
3. Scutellum with two or more pairs of large bristles....5
   Scutellum with only one pair of bristles (western species)....4
4. Face nearly or quite opaque, whitish; fore tibia and basitarsus plain. *gratiosus* Ald.
   Face almost wholly shining metallic; fore tibia and basitarsi each with a distinct bend, that of the former very conspicuous....*curvipes* V. D.
5. Propleura with a bunch of several black bristles, (western)....*plumbeus* Ald.
   Propleura without or with only one black bristle....6
6. Face and body wholly covered with yellow pollen, which is very thick in the male, (eastern)....*intentus* Ald.
   Pollen thinner and mostly gray or silvery gray, at most only slightly tinged with yellow, (western)....*argentatus* V. D.
7. Without a black propleural bristle....8
   With one black propleural bristle....13
   Usually with two or more black propleural bristles; unusually long yellow hair on the fore coxæ and femora, (Alaska)....*flavihirtus* new species.
8. Second vein very short, ending opposite the cross-vein, (Tex., Kans., S. D., Colo.)....*cerutias* Loew.
   Second vein normal, ending far beyond the cross-vein....9
9. Dorsocentrals minute, white, (Wyo., Kans., S. D., Calif.)....*canescens* Wh.
   Dorsocentrals black....10
10. Middle femora with long white hairs or bristles on lower surface; cheeks almost invisible; middle tarsi of male with the fifth joint a little enlarged. (Mich.)....*agalma* Wh.
    Cheeks distinct; middle femora without or with only very short white hairs below, (Alaska)....11
11. Wing with the cross-vein distinctly infuscated, usually forming a brown spot and sometimes with a very faint spot on the last section of fourth vein. *pectinipes* new species.
    Wings without spots on the wings....12
12. Middle tarsi of male plain; hairs on the dorsum of the abdomen wholly or mostly white....*canites* new species.
    Middle tarsi of the male with the fifth joint somewhat flattened, nearly twice as long as fourth; hairs on the dorsum of the abdomen black, except some on the hind margins of segments....*pectinipes* new species.
13. Face opaque with pollen, the ground color not showing through....14
    Face with more or less metallic color showing through the pollen....15
14. Pollen of face pure white; wings clear, without spots on the veins; veins broadly yellow at base, (U. S.)....*aestuum* Loew.
    Face ochre yellow, wings with a very conspicuous spot on the cross-vein and another on the last section of fourth vein; veins scarcely paler at base. (Canada)....*glabor* Walk.
15. Tips of fore tibiæ in both sexes with an acute angle produced toward the femora; fore coxæ with from one to three black bristles on outer upper corner....16
    Tips of fore tibiæ not or but slightly angulated....17
16. Wings without spots on the veins; face usually very bright blue-green as far down as the suture, (U. S.)....*philombreus* Wh.
    Wings with the cross-vein infuscated, usually forming a spot; upper part of the face with the ground color showing through a little, (Alaska). *pectinipes* new species.

17. Fore tibiæ of male notched on inner side at two-thirds their length; female with quite long bristles below on apical half of fore femora, (western states; Alaska)..... *breviseta* Thom.
Fore tibiæ of male not notched; fore femora of female with very small bristles below, or none at all..... 18
18. Wings with a conspicuous spot on the cross-vein and another near the middle of the last section of the fourth vein. (Alaska)..... 19
Wings clear or nearly so, without spots on the veins..... 20
19. Hairs on fore coxæ whitish or very pale yellow, delicate. (Alaska). *viridifacies* new species.
Hairs of fore coxæ deep yellow, quite long and bushy, (Alaska). *flavihirtus* new species.
20. Size 3 mm.; pleuræ with rather thick white pollen, (Wyo., Colo.)..*sodalis* Wh.
Size 4.5 mm.; pleuræ with thin yellowish pollen, (N. M., Wyo., Colo.). *magdalenæ* Wh.
21. Wings with a brown spot on the cross-vein and another on last section of fourth vein..... 22
Wings without spots on the cross-vein..... 34
22. Face opaque with pollen, the ground color not showing through..... 23
Face showing some metallic color, the pollen not wholly concealing the ground color..... 27
23. Beard composed of black bristles and some yellowish hairs; face of female yellowish brown with a gray spot on each side below the suture; male with a small protruberance below near the tip of the fore femora, (Alaska). *signiferus* Coq.
Beard yellowish, there may be a few black bristles under the neck..... 24
24. Fore coxæ with no black bristles, (Wyo.)..... *algens* Wh.
Fore coxæ with black bristles besides the row at tip..... 25
25. Wings with the spots faint; fore coxæ with a row of about 16 spines, longest towards the tip, running out proximally, (eastern)..... *pirata* Loew.
Wings with the spots very conspicuous..... 26
26. Fore coxæ with an irregular row of little black bristles on outer anterior edge; pollen of inner portion yellowish or yellowish brown, contrasting with the white pollen of the outer portion; pollen of face yellowish brown, (eastern states and Colorado)..... *chrysolgus* Walk.
Fore coxæ with two irregular rows of black bristles or stiff hairs outside of the center of the anterior surface, their pollen wholly whitish; pollen of face white, (Alaska)..... *brevicauda* new species.
27. Propleuræ without a black bristle, having only pale hairs above fore coxæ and sometimes a yellowish bristle, (B. C.)..... *phoca* Ald.
Propleuræ with a black bristle..... 28
28. Middle femora with long black bristles on anterior ventral surface, 4–5 in male and 2–3 in female, (Alaska)..... *pilitarsis* Mall.
Middle female without bristles at base..... 29
29. Females..... 30
Males..... 31
30. Fore femora with about seven small spines below, (Wyoming)....*algens* Wh.
Fore femora without spines below, (Alaska)..... *propinquus* new species.
31. Fore femora plain, without a protuberance below near the tip, (Wyoming). *algens* Wh.
Fore femora with a protruberance below near the tip, preceded by about five spines in a group, (Alaska)..... 32
32. Many black bristles mixed with the beard, Alaska, (as determined by Malloch)..... *signiferus* Coq.
Beard without black bristles, excepting sometimes a few under the neck..33
33. Fore coxæ with pale hairs, (Alaska)..... *propinquus* new species.
Fore coxæ with the hairs wholly or almost wholly black, (Alaska). *nigribarbus* new species.

34. Fore coxæ with black bristles or spines besides those at tip.....35
Fore coxæ without black bristles except at tip, (sometimes these are missing.....40
35. Face wholly opaque with pollen.....36
Face showing some metallic color, there being no pollen on upper part or the pollen thin.....37
36. Fore coxæ with a row of black spines, longer above, running out apically, (eastern).....*parvus* Loew.
Fore coxæ with a row of black spines or bristles, longer towards the tip, running out basally, (eastern).....*pirata* Loew.
The row of bristles on fore coxæ only reaching about half their length from the tip, and of nearly equal length throughout, (Alaska).
brevicauda new species.
37. Fore coxæ with black hairs and also a row of slender black bristles on outer edge of anterior surface, male of.....*nigribarbus* new species.
Hairs of fore coxæ white or yellowish.....38
38. Hairs of fore coxæ rather long, yellow; a row of 7–10 black bristles of nearly equal length on outer side of anterior surface of apical half of fore coxæ, (Alaska).....*brevicauda* new species.
Hairs of fore coxæ minute, white.....39
39. Fore coxæ with a row of 5–7 long black bristles on outer anterior edge, (Alaska and Northwest States).....*innotatus* Loew.
Fore coxæ with a row of about twelve rather short black bristles on outer edge of anterior surface; middle tibiæ nearly twice as long as their very short tarsi, (Alaska). Male of.....*fumipennis* V. D.
40. Face wholly opaque with brown pollen, (S. D., Que.).....*extrarius* Ald.
Face showing some metallic color.....41
41. Cheeks forming a small lobe below the eye, (Colorado).....*altivagus* Ald.
Cheeks narrow, not forming a lobe below the eye.....42
42. Fore femora of male with a small protruberance below near the tip, preceded by a group of small spines, (S. D., Mich., N. Y.).....*amplectens* Ald.
Fore femora plain.....43
43. Upper portion of the face bright blue-green, (Idaho, Wash.)....*pensus* Ald.
Upper portion of face dull, only a little greenish, (S. D., Que.).
extrarius Ald.

Hydrophorus signiferus Coq.

Three females which seem to belong to this species were taken at Katmai, Alaska, 1917; Kodiak, Sept. 21, 1919; and Savonoski, Naknek Lake, in July, 1919.

The most marked character of this species as I see it is the numerous black bristles mixed with the berad. Mr. J. R. Malloch, in the Report of the Canadian Arctic Expedition 1913–1918, Vol. III, p. 51c describes what he considers the male of this species, if he is correct it belongs to the group of species with a protuberance below the fore femora near their tip, in all the species having this protuberance it is preceded by a group of five or six small blunt bristles or spines, this male he describes has numerous black bristles mixed with the beard the same as Mr. Coquellitt's female had, it is the only male that I know of with these black bristles and no doubt Mr. Malloch's determination of this male is correct.

Hydrophorus breviseta, Thompson.

This species is represented by 116 males and 100 females; most of these were taken at Katmai, on Aug. 23d, and at Kodiak, Sept. 1, a few were taken at Katmai in June.

Hydrophorus canities, new species.

Male: Length 3.5–4 mm.; of wing, 5 mm. Face wholly covered with silvery white pollen, still the metallic ground color sometimes shows through a very little below the antennæ, where the pollen is sometimes a little yellowish; cheeks and palpi with gray pollen, the former narrow and latter rather small with white hairs. Beard white, sometimes a little yellowish; there are a few black bristles below the neck; the black orbital cilia descend to the middle of the eye. Occiput greenish, the upper part often nearly opaque with brown pollen, its orbits white pollinose; one pair of postvertical bristles. Front slightly greenish, often opaque with brown pollen. Antennæ black; third joint small, roundish; arista black with apical half whitish.

Thorax green or bronze brown with more or less coppery reflections, its pollen brown; scutellum sometimes steel-blue; it has four to six marginal bristles; humeri with one or two bristles and usually several pale hairs; propleuræ with a bunch of long, stiff whitish hairs, without a black bristle; acrostichals reaching the posterior slope of the thorax; dorsocentrals about ten in a row; pleuræ and coxæ covered with gray pollen. Abdomen green with long white hairs. Hypopygium and its appendages mostly concealed.

All coxæ with rather long white hair on their anterior surface, but without black bristles, even at tip there are no black spines. Femora and tibiæ metallic green or coppery, their hairs wholly white, but short, except a few at tip of middle femora below and on upper portion of fore femora, where they are a little longer. Fore femora (Figs. 7 and 7 a) moderately thickened towards their base, with a row of about eight blunt black spines below on basal half and an irregular row of smaller ones outside of these, a row of 2–4 on apical half of front surface and one longer bristle near the tip on posterior side near the lower edge, (the inner row near the base are often difficult to see). Fore tibiæ with a comb-like row of very short spines on whole inner side, about twenty-five in number, their tips not angulated towards the femora. Middle femora with a few very short bristles, those on the lower edge about six in number and about equally spaced along their whole length. Tarsi brownish black with white hairs; fore tarsi with the first joint as long as the three following joints taken together, third and fifth of equal length, fourth very slightly shorter than fifth. Halteres yellow, knob not or scarcely darker on outer surface. Calypters yellow with white cilia.

Wings grayish, sometimes slightly tinged with yellowish brown on costal half; without spots on the veins, the cross-vein not at all infuscated; veins brown, usually yellowish at base of wing; costa black

from the tip of first vein, yellowish at base; first vein usually wholly yellow; third and fourth veins a very little recurved at their tips, as they usually are in this genus.

Female: Much like the male in color. Face a little wider, its pollen yellowish, except below the suture, where it is yellow in the center and almost white on the sides, especially near the suture; the fore femora are less thickened and have a scattering row of very small spines on lower anterior edge and two small bristles near the tip on lower posterior edge, still the spines are sometimes arranged about as in the male, but are shorter.

Described from eighteen males and fifteen females from Alaska. Eighteen specimens were taken at Savonoaski, Naknek Lake, in June, July and August; six at Kodiak, in September and June; and three at Katmai, in July, and one in August.

Hydrophorus pectinipes, new species.

Male: Length, 4 mm.; of wing, 4–4.5 mm. Face widening below, covered with white pollen which wholly, or very nearly, conceals the ground color. Palpi black with a little gray pollen and white hairs. Cheeks wide, lobe-like, gray pollinose. Front green with gray pollen. Occiput green, with white pollen; one pair of postvertical bristles. Beard white; I can see two black bristles under the neck; the black orbital cilia scarcely reaching down to the middle of the eye. Antennæ black; third joint small, nearly round; arista black, its apical half with a whitish reflection; it is longer than the antenna.

Thorax green, somewhat shining, but dulled with brownish gray pollen and with blue or coppery lines. Pleuræ, coxæ, fore femora and sides of abdomen green, with thin whitish pollen. Acrostichal bristles 5–6 in number, dorsocentrals 7–9 in a row, one or two humerial bristles; propleuræ with one black bristle and several pale hairs; scutellum with four strong bristles. Dorsum of the abdomen shining green, with black hairs. Hypopygium almost entirely concealed.

Fore coxæ with delicate white hairs, no black spines at tip, but with one or two black bristles at outer basal angle. Fore femora (Fig. 8) thickened, not tapering much until about their middle, but slightly hollowed below in outline on basal half, with four long black bristles at base on lower posterior side and a row of about six small spines on lower anterior surface, which are continued towards the tip by several minute spines; they are nearly bare on the sides with a few pale hairs on upper and lower edges, the longest being at the base below. Fore tibiæ (Fig. 8) nearly straight, but rather stout, distinctly angled towards the femora at tip, with a comb-like row of erect spines on whole inner side, their hairs pale, those on anterior surface longer and having a golden reflection in certain lights. Middle and hind femora and tibiæ shining green, the former with their hairs largely black, the latter with pale hairs. Tarsi brownish; last joint of middle tarsi slightly widened, somewhat round in outline, longer than fourth; hind tarsi also with the

last joint very slightly widened and longer than fourth joint. Calypters brownish with white cilia. Halteres yellow, their stem brownish at base.

Wings tinged with brownish gray; cross-vein with a quite distinct brown cloud and sometimes there is a trace of a brown spot on last section of fourth vein; veins blackish; third and fourth veins slightly recurved at their tips.

Female: Females that probably belong here have the fore femora rather wide at base, tapering, with a minute pair of spines at basal third; fore coxæ have no black bristles at base. Face narrow (the head may be compressed or shriveled), bluish gray; fore tibiæ not angulated at tip. Middle tarsi normal, with the fourth and fifth joints of nearly equal length.

Described from three males and one female taken at Savonoski, Naknek Lake, Alaska, in July, 1919; and two females and three males taken at Katmai, Alaska, in August, 1917, and July and August, 1919.

This is much like *philombrius* Wh. in the spinulation of fore femora and in having a bristle or two at base of fore coxæ, but it differs in having no black spines at tip of fore coxæ; in having the face wholly or almost wholly white opaque; the femora are not so evenly tapered, and the cross-vein is infuscated.

Hydrophorus viridifacies, new species.

Male: Length, 2.5–3.5 mm.; of wing, 4 mm.; length of female, 3–4.5 mm.; of wing of female, 4.5–5 mm. Face usually shining green above the suture, the lower part covered with white pollen, still the ground color shows through more or less on the lower part, sometimes the pollen is a little darker in color and dulls even the upper portion of the face. Front green, nearly opaque with brown pollen. Occiput metallic green or coppery red, not very bright. Beard white, with more or less of a golden luster, especially near the roots of the hairs; there are several black bristles under the neck; the black orbital cilia descend to the lower third of the eye; one pair of postvertical bristles. Palpi black with gray pollen and white hairs. Antennæ black; third joint small, somewhat round, notched at tip.

Thorax bronze brown, with green coppery reflections, and with thick brown pollen; pleuræ more metallic with gray pollen; propleuræ with one black bristle and several stout pale hairs; acrostichal bristles numerous and extending to the posterior slope of the thorax; about seven dorsocentrals in each row; two humeral bristles; scutellum with four large bristles. Abdomen green, dulled with white pollen, which is thick and silvery on the sides, its hairs pale. Hypopygium mostly concealed.

Fore coxæ with yellowish white hair and one black spine at tip on outer corner. Femora and tibiæ green, their hairs pale. Fore femora (Fig. 11) thickened near the base, tapering, with about eight rather long spines below on basal half. Fore tibiæ straight, without spines on inner side, but with several small bristles. Tarsi brownish; fore tarsi with the first joint nearly as long as the three following joints taken together, fourth and fifth of nearly equal length. Calypters and halteres yellow, the former with whitish cilia.

Wings dark grayish; veins brownish black, usually broadly yellowish at base; a brown spot on the cross-vein and another on the middle of the last section of fourth vein, these spots distinct to the naked eye; third and fourth veins a little recurved at tip.

Female: Face with the pollen more yellow. Fore coxæ with two or more black spines at tip. Fore femora without spines below, or with one very minute one near the middle; hairs on the middle and hind femora partly black. Otherwise about as in the male.

Described from 25 males and 32 females from Alaska. These were taken at Katmai, July and August 23, 1917, and at Savonoski, Naknek Lake, in June, July and August, 1919.

The typical form has the face bright green above with white pollen below in both sexes, but many specimens that I cannot separate have the pollen more yellow and covering most of the face.

This form is something like *chrysologus* Walker, but that species has the front and face wholly opaque with yellowish brown pollen, and the fore femora has two rows of rather large spines below, all of which is different in this species. The knobs of the halteres are also blackish in *chrysologus*, while in this species they are wholly yellow. I have a specimen which I took at Kearney, Ont., which I have determined as *glabor* Walker. It is very nearly like *Chrysologus*, but is smaller and has the halteres wholly yellow, and has the face very much narrowed above, much more so than in chryoloffus.

Hydrophorus propinquus, new species.

Male: Length, 4–5 mm.; of wing, 5 mm. Face wide, with white pollen, the metallic ground color showing through on upper portion, usually nearly down to the suture, ground color green, but just below the antennæ it is more bronze and has thin brownish pollen. Palpi black with black hairs. Front wholly opaque brown. Occiput green, with a little brown pollen just back of the vertex, along the orbits and on the narrow cheeks the pollen is gray. Beard yellow; there are some black bristles under the neck; the black orbital cilia descend to about the lower fifth of the eye; one pair of postvertical bristles. Antennæ

black; third joint rather small, rounded; arista longer than the antennæ, with a whitish reflection at tip.

Dorsum of thorax polished brown or blackish, a little green on lateral edges where there is thick brown pollen; pleuræ more green with thick white pollen on lower portion; two humeral bristles; about ten dorsocentrals in each row; scutellum with two marginal bristles; propleuræ with a cluster of pale hairs just above the fore coxæ and above these a large black bristle. Abdomen green, upper surface shining with coppery reflections and black hairs, its sides thickly white pollinose and with some long pale hairs; venter grayish, with a few pale hairs. Hypopygium concealed, its outer lamellæ projecting posteriorly, large, oval, fringed with little white hairs, its other appendages usually wholly concealed.

Anterior surface of fore coxæ green, with white pollen and yellowish hairs; on the outer edge of apical half there is a row of about six black bristle-like hairs and at tip about four more; middle and hind coxæ black with thick white pollen; middle pair with the hairs on outer half of anterior surface black, those on inner edge and at tip long and pale. Femora and tibiæ green, their hairs largely black, still there are many pale ones on upper and lower surfaces of the middle and hind pairs of femora, and those on the tibiæ may be largely pale. Fore femora (Fig. 9) not much thickened, the lower surface on its anterior edge with a row of short spines; near the tip there is a small protuberance, preceded by six long stout bristles and one long bristle at tip; seen from above these femora are quite crooked; their tibiæ rather stout, with a small tubercle near the base on anterior surface, the row of black spines on inner surface are erect and rather long, not quite reaching the tip; the anterior surface of apical half or more with conspicuous yellow hairs; their tips normal, not angulated towards the femora. Tarsi blackish, plain. Halteres yellow, with the outer surface of the knob blackened. Calypters brownish yellow, with pale yellow cilia.

Wings grayish; cross-vein clouded with brown; a small brown spot near the middle of the last section of fourth vein; veins wholly blackish; third and fourth veins slightly recurved at their tips.

Female: Face with brown pollen, the ground color showing through above. Fore coxæ with the hairs partly black. Fore femora without spines below, except two or three small ones near the tip, they have a very slight protuberance below near the tip (easily overlooked); fore tibiæ plain, with a few slanting spines on inner surface. Otherwise about as in the male.

Described from 32 males and 28 females from Alaska. They were taken at Katmai, in July and August, 1917; Kodiak, June, 1917, and September, 1919; and Savonoski, Naknek Lake, in July and August, 1919.

Hydrophorus nigribarbus, new species.

The male is very much like the male described above, except that the hairs of the fore coxæ are wholly black; those

on middle coxæ also seem to be wholly black; the spines on the lower surface of fore femora are less conspicuous; the wings are conspicuously tinged with brown along the front and the veins are margined with brown, the fore femora are formed about as in the preceding species. The specimen from Savonoski has the wings nearly clear except the spots on the veins.

Described from five males taken at Katmai, Alaska, in July and August, 1917, and one male taken at Savonoski, Naknek Lake, Alaska, in August, 1919.

The female of this is probably about the same as that of the species above and no doubt are mixed with those of that species, but I cannot separate them.

This makes seven species described with nearly the same form of male fore femora, that is with a protuberance below near the tip, proceeded by a few blunt spines. Three are from Europe and four from North America; the European species are *borealis* Loew; *albiceps* Frey, and *magnicornis* Frey; from America we have *amplectens* Ald., from Brookings, S. D.; Battle Creek, Mich., and Essex Co., N. Y. This differs from all the other species in having the wings clear, without spots on the veins, and it also differs from all others in having the pollen of the face brownish yellow, except *signiferus* Coq., the male of which has the pollen more or less yellowish brown (male as determined by Malloch), but in that species the beard is composed of black bristles mixed with pale hairs; in all the other six species the beard is pale, with sometimes a few black bristles under the neck; all the other five species have the pollen of the face white or silvery; *albiceps* has the face wholly covered with white pollen; the other four show the metallic ground color on the upper part of the face; *Magnicornis* differs from the others in having the third antennal joint unusually large; in all the other forms the third joint is small or rather small and round or nearly so; *propinquus* differs from *borealis* and *nigribarbus* in having the hairs of the fore coxæ wholly pale and those on middle coxæ partly pale. Perhaps *nigribarbus* described above will prove to be *borealis*, but it differs from Dr. Lundbeck's description of that species in having the wings brown in front and in lacking the dense hair on fore femora; still they must be compared to make sure that they are not one species, especially as both are arctic.

Hydrophorus flavihirtus, new species.

Male: Length, 4.2 mm.; of wing, 4.5 mm. Face broad, but little narrowed above, dark but shining green, with only a little brownish yellow pollen on the sides and lower edge of the portion below the suture. Palpi black, with yellow hairs. Front opaque brown. Occiput more metallic, with one pair of postvertical bristles; about twelve black orbital cilia on each side, reaching down to the middle of the eye. Beard golden or orange yellow, with black bristles under the neck. No cheeks visible. Antennæ black, third joint small, about as long as wide, truncate at tip; arista nearly twice as long as the antennæ.

Dorsum of thorax metallic brown with green reflections and brown pollen; pleuræ more green with yellowish brown pollen; propleuræ with two or three black bristles and several pale hairs (these black bristles may have a yellowish reflection in certain lights). Abdomen green, with black hairs above and a very few white ones on the sides at base, its lower edges with thick white pollen. Hypopygium concealed, its outer lamellæ nearly as long as the hind basitarsus, not half as wide as long, fringed with a few small white hairs.

Fore coxæ greenish, with a little yellow pollen and long, stiff, almost golden yellow hairs on anterior surface; there are several small black spines at tip. Fore femora (Fig. 10) considerably thickened at base, with a row of about eight rather long black spines on basal half below, and about the same number of thinner ones in a row on lower posterior edge of apical half, besides these they have black hairs on the sides and abundant, rather long, yellow hair all over. Fore tibiæ with a row of rather short, erect spines on lower or inner side and longer black bristles above, also numerous pale hairs on upper and lower edges and some black hairs on the sides. Middle and hind femora and tibiæ green, with black and pale hairs, those on lower surface mostly pale and longer. Tarsi blackish, of the usual form. Calypters and halteres dark yellow, the former with yellow cilia, the knobs of the halteres scarcely darker on outer surface.

Wings blackish gray, tinged with brown in front of third vein, with a dark brown spot on the cross-vein and another on the middle of the last section of the fourth vein; veins wholly blackish; third and fourth veins nearly parallel towards their tips.

Female: Agrees with the male in color. Hair on the fore femora and coxæ unusually long and yellow, as in the male; no black spines below on the fore femora.

Described from one pair taken at Savonoski, Naknek Lake, Alaska, in July and August, 1919; and one female taken at Katmai, Alaska, in August, 1917.

Hydrophorus brevicauda, new species.

Male: Length, 4–4.2 mm.; of wing, 5–5.3 mm. Face usually quite bright green above, with white pollen covering most of the lower part, but sometimes the ground color is nearly or wholly concealed by white

pollen. Palpi with yellowish pollen and both black and yellow hairs on the upper surface. Cheeks wide, lobe-like. Front opaque dark brown, still sometimes the green ground color shows through a little. Occiput metallic with the orbits and cheeks gray pollinose; one pair of postvertical bristles. Beard golden yellow, long, but not very abundant, with several black bristles under the neck; black orbital cilia descending nearly to the lower fourth of the eye. Antennæ black, third joint small, about as long as wide, truncate and with a notch at tip.

Dorsum of thorax bronze brown, its lateral sides quite bright green; pleuræ greenish, with its pollen a little brown above, white below; acrostichal bristles long and reaching the posterior slope of the thorax; 10–12 dorsocentral bristles in each row; propleuræ with long bristle-like yellow hairs and one large black bristle. Abdomen green, with black hairs above and abundant yellow hairs on the sides for its entire length. Hypopygium concealed, its outer lamellæ usually projecting about as far as the length of the third antennal joint, sometimes a little more when they are fully extended.

Fore coxæ green, with white pollen; their anterior surface with bright yellow hair, which is much longer on outer half, especially at base, and with a row of black bristles on outer edge of apical half; these are usually eight in a row; there are also a few black spines at tip; middle coxæ with their hairs partly black and partly yellowish. Fore femora a little thickened near the base, their hairs largely black; they have a few very small spines below on basal half, which seem to be in two irregular rows, the posterior one continued nearly to the tip by little hair-like black bristles. Fore tibiæ with a row of very short, erect spines on whole inner side. All femora and tibiæ metallic green. Tarsi blackish. Calypters yellow, their cilia pale yellow. Knobs of halteres black, their stem and sometimes the inner surface of the knob more yellowish.

Wings dark gray, without spots on the veins; veins black, not paler at the base of the wing; third vein considerably bent near its tip, which is scarcely recurved; last section of fourth vein nearly straight.

Female: Pollen of the face more yellowish brown, upper part of face metallic green; beard and fore coxæ with the same deep yellow hairs as in the male; fore coxæ with fewer black spines on outer edge; fore femora without spines below; fore tibia without the row of spines on inner side; wings about as in the male.

Described from eleven males and nine females, all taken at Savonoski, Naknek Lake, Alaska, in July and August, 1919.

This is like *flavihirtus*, new species, in having the beard almost golden yellow and the fore coxæ with long yellow hair. The male differs in having short outer lamellæ, much shorter hair on fore femora, in having a row of small black bristles on apical half of fore coxæ, the third vein is more abruptly bent near the tip, and the wings are without spots on the veins. The females differ in the wing characters in the same manner as the males.

Although there is a great difference in the amount of white pollen on the face of several of the males, still I think they are all one species.

Dolichopus solidus, VanDuzee, Cole & Aldrich.

One male of this species was taken at Savonoski, Naknek Lake, Alaska, in July, 1919.

This species was described from a single male from Alaska, which was in very poor condition, all the tarsi being partly or wholly broken off, so I will give the following characters not contained in the original description of the species published in the U. S. National Museum Bulletin 116, p. 104, 1921.

Fore tarsi a little more than one and a fourth times as long as their tibiæ, first joint scarcely as long as the two following taken together, second and third joints of nearly equal length, fourth and fifth joints compressed and fringed on each side, forming together a nearly round tip to the tarsi, the two joints of equal length. In this specimen the hind tibiæ are nearly wholly blackened and considerably thickened, the middle tarsi infuscated almost to their base, the whole of the legs and feet being darker than in the type specimen. The cilia of the calypters is decidedly black in certain lights, in other lights it is quite yellowish; in the type it was black; if yellow in any light I did not notice it.

Dolichopus rupestris, Hall.

Thirteen examples were taken at Katmai, Alaska, in August, 1917.

Dolichopus renidescens, Melander and Brues.

Eighteen examples were taken at Savonoski, Naknek Lake, Alaska, twelve in July and six on August 1, 1919. This is the first record of this species from Alaska.

Dolichopus discifer, Stam.

One specimen was taken at Katmai, Alaska, in August, 1917.

Dolichopus deterus, Loew.

One specimen was taken at Savonoski, Naknek Lake, Alaska, in 1919. This is the first record of the species from Alaska or any of the western states.

Dolichopus litoralis, Van Duzee, Cole & Aldrich.

One example was taken at Katmai, Alaska, in August, 1917. This was described from two males taken in the state of Washington.

Dolichopus sp.

One female taken at Katmai, Alaska, in August, 1917. This would run in the table of females in the U. S. National Museum Bulletin 116, 1921, on page 30, couplet 60, to *xanthocnemus*, but is a stouter species and the pollen of the face is more gray, not white, the middle femora are also deep black, with only their tips yellow; in *xanthocnemus* the middle femora are broadly yellow at tip, the yellow shading into the black. This seems to belong to an undescribed species.

Dolichopus uxorcula, Van Duzee, Cole & Aldrich.

One male and four females were taken. One female at Katmai, Alaska, in July, 1917, and three females and the male at the same place in August, 1917.

This was described from females; the following is a description of the male:

Length, 3.5 mm.; of these females, 4 mm. Face moderately wide, silvery white, palpi yellow. Front shining green. First antennal joint yellow, with the extreme upper edge a little brown; second and third joint black, third a little longer than wide, pointed at tip; lateral and inferior orbital cilia white.

Hypopygium black; its lamellæ of moderate size, somewhat oval, but tapering into the stem, white with a rather wide black apical border, jagged and bristly at apex.

Fore coxæ wholly yellow, their anterior surface covered with silvery white pollen and minute black hairs, a few on the outer edge yellow; middle tibiæ with an elongated silvery or opalescent spot on upper surface at tip which extends for about one-fourth their length. The black hairs on the sides of hind femora very small, but extending nearly to the lower edge; no longer hairs below. Hind tibiæ black at tip for one-sixth their length, only a little thickened, the glabrous streak on upper edge between the rows of large bristles can be traced, but is indistinct.

Middle tarsi about as long as their tibiæ, wholly deep black; first joint without a bristle above; as long as the two following taken together. Hind tarsi wholly black.

Wings grayish hyaline; costa not or scarcely enlarged at tip of first vein; last section of fourth vein a little bent before its middle, nearly parallel with third towards its tip; anal angle very prominent.

The female has the first two antennal joints and part of third yellow, while this male has only the first joint yellow; still I have no doubt of their being the same species.

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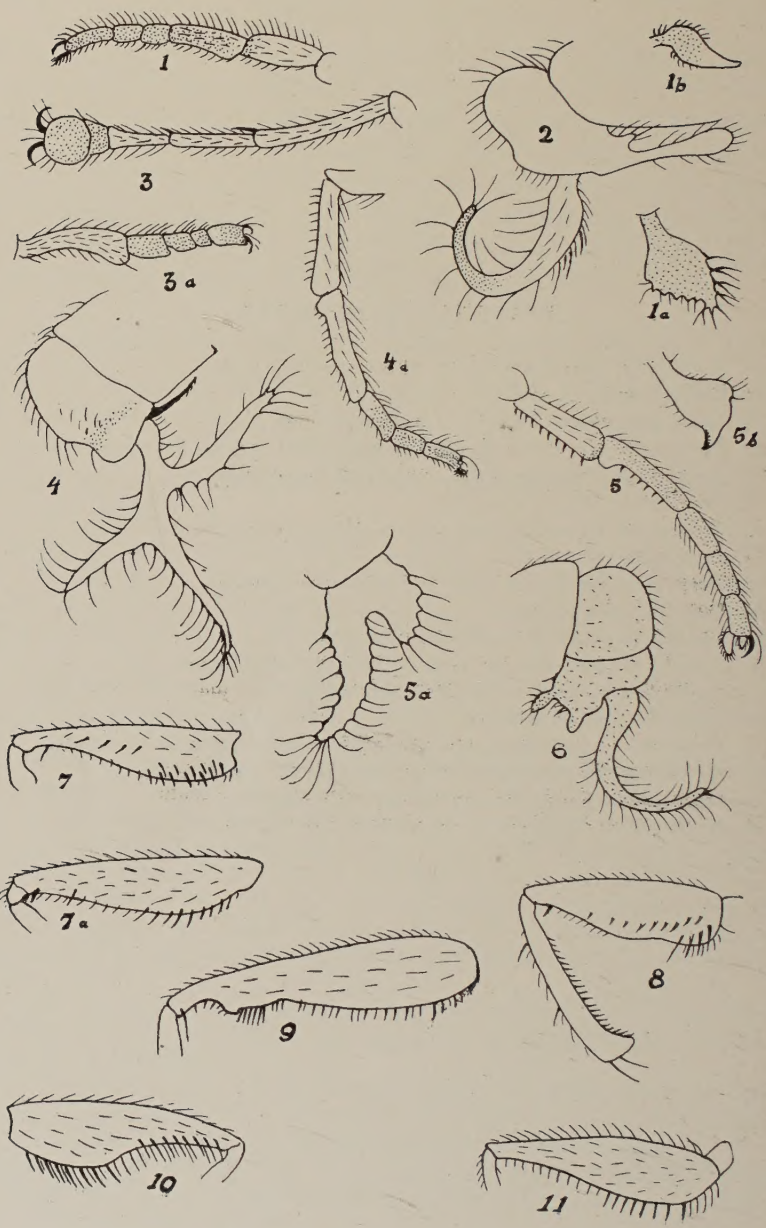
EXPLANATION OF PLATE.

Fig. 1. *Porphyrops consobrinus* Zett. Fore tarsus of male.
Fig. 1a. Outer lamella of same.
Fig. 1b. Inner appendage of the hypopygium of same.
Fig. 2. *Porphyrops elagantula* Meig., hypopygium of male.
Fig. 3. *Porphyrops crassipes* Meig., middle tarsus of male.
Fig. 3a. Fore tarsus of male of same.
Fig. 4. *Porphyrops tricaudata,* new species, Hypopygium of male.
Fig. 4a. Fore tarsus of same.
Fig. 5. *Porphyrops nigra,* new species, fore tarsus of male.
Fig. 5a. Outer lamella of same.
Fig. 5b. Inner appendage of hypopygium of same.
Fig. 6. *Porphyrops borealis,* new species, hypopygium of male.
Fig. 7. *Hydrophorus canities* new species, fore femora of male, anterior side.
Fig. 7a. Posterior side of same.
Fig. 8. *Hydrophorus pictinipes,* new species, fore femora and tibia of male.
Fig. 9. *Hydrophorus propinquus* new species, fore femora of male.
Fig. 10. *Hydrophorus flavihirtus* new species, fore femora of male.
Fig. 11. *Hydrophorus viridifacies,* new species, fore femora of male.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